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JAMES MILLER, F.R.S.E., F.R.C.S.E.,

AUTHOR OF A TREATISE ON THE PRACTICE OF SURGERY;
SURGEON IN ORDINARY TO THE QUEEN FOR SCOTLAND;
SURGEON IN ORDINARY TO HIS ROYAL HIGHNESS PRINCE ALBERT FOR SCOTLAND
PROFESSOR OF SURGERY IN THE UNIVERSITY OF EDINBURGH;
CONSULTING SURGEON TO THE ROYAL INFIRMARY;
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OWING to the absence in Europe of Dr. Sargent, Editor of the last American Edition, the present volume has been passed through the press without his editorial supervision, the Author having had the opportunity of embodying in his text such of Dr. Sargent's notes as he deemed advisable. The aim of the publishers has therefore been merely to render the work an exact transcript of the Author's last and revised edition.

PHILADELPHIA, February, 1856.

PREFACE TO THE THIRD EDITION.

In presenting a Third Edition of this work to the public, in obedience to their favorable reception of the former volumes, the Author has endeavored to make such alterations in arrangement and text as seemed necessary; seeking to deserve the continuance of his readers' goodwill, which, gratefully experienced in the past, is here acknowledged with thanks, and humbly hoped for in the future.

51 Queen Street,
Sept. 1853.

PREFACE TO THE SECOND EDITION.

By ample correction, and no inconsiderable addition to the text, has been the Author's anxious desire to render his Volume better serving of the kind reception awarded to its original issue.

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At the end of each subject, references have been made to its rature; selected with a view to usefulness and accessibility, her than a completeness of enumeration.

To more than one friend the acknowledgment of obligation is e. To Dr. Bennett, for the use of many Woodcut Illustrations the Inflammatory Process, and of Tumors. To Dr. Redfern, for ike favor, in regard to the Diseases of Cartilage. To Mr. Spence, access to his illustrations of the Effects of Ligature on Arteries. d to my friend and former pupil, Dr. W. T. Gairdner, most ecially, for his kind and valuable aid in preparing these pages the press

PREFACE TO THE FIRST EDITION.

THE following pages, intended to exhibit a condensed view of e Principles of the Healing Art, contain the substance of the uthor's systematic Lectures on the subject. In their preparation, has been his aim to combine, with soundness of doctrine, such nplicity of arrangement, and plainness of illustration, as seem st calculated to facilitate, while they direct, the labors of the udent.

To his own Pupils, the Volume is offered as one of reference, as ell as a text-book; and he ventures to hope, that to others also it ay prove of service as a concise exposition of the Science of odern Surgery.

CONTENTS.

SECTION I.

ELEMENTARY DISEASE.

CHAPTER I.

CONSTITUTIONAL AFFECTIONS IN SURGERY.

PAGE
ERS, 34
  Inflammatory Fever, 37
  Typhoid Fever, 40
  Hectic Fever, 42
  Irritative Fever, 44
  Treatment of Fevers, 45

HECTIC AFFECTIONS, 49
  Scrofula, 50
  Cancer, 58
  Syphilis, 60
  Rheumatism, 61
  Gout, 62
  Scurvy, 64

ECTIONS OF THE NERVOUS SYSTEM, 67
  Disorder of the Mental Functions, 68
  Disorder of Sensation, 70
  Disorder of Motion, 72
  Irritation, 75
  Shock of Injury, 81
  Delirium Tremens, 85
  Hysteria, Spinal Irritation, &c. 87

ECTIONS OF INTERNAL ORGANS IN CONNECTION WITH SURGICAL DISEASE, 89

CHAPTER II.

THE INFLAMMATORY PROCESS, AND CONGESTION.

E INFLAMMATORY PROCESS, 94
  Its Theory, 95

PAGE
Local Symptoms, ... 100
Extension, ... 108
Appearances of the Bl od, ... 110
Causes, ... 112
Duration and Charact , ... 114
Results of the Inflam atory Process, ... 115
Resolution, ... 115
Excessive Deposit, ... 117
Suppuration, ... 123
Ulceration and Sloughi ng, ... 128
Varieties of the Inflam natory Process, ... 132
The Chronic Inflamm ory Process 133
Management of the In 134
Prevention, ... 134
General Treatment, ... 135
Local Treatment, ... 154

NGESTION, ... 169
Active Congestion, ... 169
Passive Congestion, ... 170

IE HEALING PROCESS, ... 174
Healing by Adhesion, ... 175
" Growth, ... 175
" the Modelling Process, ... 176
" Granulation, ... 177

CHAPTER IV.

PPURATION, ... 181
Acute Abscess, ... 181
Chronic Abscess, ... 192
Sinus, ... 197
Fistula, ... 199
Constitutional Treatment of Abscess, ... 200
Diffuse Abscess, or Purulent Infiltration, ... 201
Secondary Abscess, ... 203
Pyæmia, ... 204

CHAPTER V.

LCERS, ... 207
The Simple Purulent, or Healthy Sore, ... 208
The Weak Sore, ... 212
The Scrofulous Sore, ... 214
The Cachectic Sore, ... 217
The Indolent Sore, ... 218
The Irritable Sore, ... 223
The Inflamed Sore, ... 225
The Sloughing Sore, ... 225
The Phagedenic Sore, ... 227

PAGE
The Sloughing Phagedena, ... 227
Peculiarities of Ulcers, ... 231
The Varicose Ulcer, ... 231
The Sinuous Ulcer, ... 232
The Pustular Sore, ... 232
Podelkoma, ... 232
The Vicarious Ulcer, ... 233
The Constitutional Ulcer, ... 233

CHAPTER VI.

MORTIFICATION, ... 235
Gangrene and Sphacelus, ... 235
Constitutional Symptoms, ... 237
Causes, ... 239
Treatment, ... 247
Local Applications, ... 252
Question of Amputation, ... 253

CHAPTER VII.

HYPERTROPHY, ATROPHY, AND ABSORPTION, ... 257
Hypertrophy, ... 257
Atrophy, ... 258
Absorption, ... 259

CHAPTER VIII.

TUMORS.

General Observations on Tumors, ... 262
Classification, ... 269
Non-malignant Tumors, ... 269
Malignant Tumors, ... 279
General Observations on the Removal of Tumors, ... 297
Encysted Tumors, ... 301

CHAPTER IX.

HEMORRHAGE.

Inflammatory Hemorrhage and Extravasation, ... 305
Traumatic Hemorrhage, ... 306
Arterial Hemorrhage, ... 306
Natural Hemostatics, ... 306
Surgical Hemostatics, ... 310
Secondary Hemorrhage after Arterial Wound, ... 322
Venous Hemorrhage, ... 323
The Effects of Loss of Blood, ... 325
The Hemorrhagic Diathesis, ... 328

SECTION II.

MORBID ACTION IN CERTAIN TISSUES.

CHAPTER X.

PAGE
Erythema, ... 333
Erysipelas, ... 334
Simple Erysipelas, ... 335
Phlegmonous Erysipelas, ... 340
Œdematous Erysipelas, ... 345
Bilious Erysipelas, ... 345
Erratic Erysipelas, ... 346
Periodic Erysipelas, ... 346
Hospital Erysipelas, ... 347
General Characters of Erysipelas, ... 347
Hospital Gangrene, ... 348
Furunculus, ... 351
Carbuncle, ... 352
Diffuse Inflammation of the Areolar Tissue, ... 354
Entozoa which affect the Integument, ... 355
Tumors of the Integument, ... 356

CHAPTER XI.

Affections of the Serous and Mucous Membranes.
Inflammatory Process affecting Serous Membrane, ... 358
Inflammatory Process affecting Mucous Membrane, ... 359
Tumors of Mucous Membrane, ... 361

CHAPTER XII.

Affections of the Periosteum and Bone.
Periostitis, ... 363
Neuralgia of Periosteum, ... 368
Malignant Disease of Periosteum, ... 369
Hypertrophy of Bone, ... 369
Atrophy of Bone, ... 369
Neuralgia of Bone, ... 370
Ostitis, ... 370
Change of Structure in Bone, ... 371
Suppuration of Bone, ... 372
Absorption of Bone, ... 380
Ulceration of Bone, ... 381
Caries, ... 382
Necrosis, ... 389
Fragilitas Ossium, ... 408
Mollities Ossium, ... 409
Rickets, ... 441
Tumors of Bone, ... 417
Exostosis, ... 417

PAGE
Osteoma, ... 420
Enchondroma, ... 420
Osteocystoma, ... 421
Osteosarcoma, ... 422
Osteocephaloma, ... 423
Osteocarcinoma, ... 427
Osteomelanosis, ... 427
Vascular Tumors of Bone, ... 427
Pulsating Tumors of Bone, ... 428
Entozoa in Bone, ... 428

CHAPTER XIII.

ECTIONS OF THE JOINTS.

Synovitis, ... 430
Acute Synovitis, ... 430
Chronic Synovitis, ... 435
Fimbriated Synovial Membrane, ... 440
The Inflammatory Process in the Exterior of Joints, ... 442
Tophi, ... 443
Disease of Cartilage, ... 444
Simple Destruction of Cartilage, ... 447
Scrofulous Destruction of Cartilage, ... 456
Hypertrophy of Cartilage, ... 458
Atrophy of Cartilage, ... 459
Porcellanous Deposit, ... 459
Osseous Deposit exterior to the Articulation, ... 460
Change of Form in Joints, ... 460
Loose Bodies in Joints, ... 462
Destruction of Bone in Joints, ... 466
Resection of Joints, ... 468
Anchylosis, ... 470
Neuralgia of Joints, ... 472
Wounds of Joints, ... 473
Affections of Bursæ, ... 475
Affections of Thecæ, ... 477
Ganglion, ... 478

CHAPTER XIV.

CTIONS OF THE ARTERIES.

Acute Arteritis, ... 479
Chronic Arteritis, ... 481
Aneurism, ... 483
True Aneurism, ... 483
Varieties of True Aneurism, ... 484
False Aneurism, ... 486
Symptoms and Progress of Aneurism, ... 488
Diagnosis of Aneurism, ... 492
Causes of Aneurism, ... 494
Cure of Aneurism, ... 495
Casualties of Operation, ... 515
Treatment of Aneurism beyond the reach of Surgery, ... 518

Treatment of False Aneurism,
Varicose Aneurism,
Aneurismal Varix,
Aneurism by Anastomosis, or Erectile Tumor,
Arterial Varix,

CHAPTER XV.

AFFECTIONS OF THE VEINS.

Phlebitis, ... 4
Varix, ... 4
Entrance of Air into V 4

XVI.

AFFECTIONS OF THE LYMPH.

Angeioleucitis, ... 5
Glandular Tumors, ... 5

XVII.

AFFECTIONS OF THE NERVES.

Neuritis, ... 5
Neuralgia, ... 5
Tumors of Nerves, ... 5

SECTION III.

INJURIES.

CHAPTER XVIII.

WOUNDS.

Incised Wounds, ... 5
Treatment of Wounds, ... 5
Making of Wounds, ... 5
Contused and Lacerated Wounds, ... 5
Punctured Wounds, ... 5
Poisoned Wounds, ... 5
Poisoned Wounds by Dissection, ... 5
Poisoned Wounds by Healthy Animals, ... 5
Poisoned Wounds by Diseased Animals, ... 5
Malignant Pustule, ... 5
Gunshot Wounds, ... 5
Subcutaneous Wounds, ... 5
Tetanus, ... 5

CHAPTER XIX.

PAGE
ECTS OF HEAT.
Burns and Scalds, ... 602

CHAPTER XX.

ECTS OF COLD.
Frost-bite, ... 609
Chilblains, ... 609

CHAPTER XXI.

CTURE.
Fractures, ... 611
Treatment of Fracture, ... 620
Fracture with Luxation, ... 625
Compound Fracture, ... 625
Diastasis, ... 629
False Joint, ... 629
Treatment of False Joints, ... 630

CHAPTER XXII.

LOCATION.
Dislocation, ... 635
Compound Dislocation, ... 644
Subluxation, ... 645

CHAPTER XXIII.

AIN, AND RUPTURE OF MUSCLE AND TENDON.
Sprain, ... 647
Rupture of Muscle, ... 648
Rupture of Tendon, ... 648
Ununited Tendon, ... 649
Displacement of Tendon, ... 649
Hypertrophy of Tendon, ... 649

CHAPTER XXIV.

ISE.
Bruise, ... 651
Ecchymosis, ... 653

CHAPTER XXV.

PENDED ANIMATION.
By Syncope, ... 654
By Strangulation, ... 654
By Immersion, ... 655

PAGE
By Noxious Gases, ... 656
By Lightning, ... 657
By Cold, ... 657
By Poisons, ... 657

CHAPTER XXVI.

ANÆSTHESIA IN SURGERY, ... 658

APPENDIX.

HISTORICAL NOTICE OF SURGERY, ... 663

LIST OF ILLUSTRATIONS.

PAGE
1. Tubercle corpuscles and granules from the lungs, ... 54
2. " " from a mesenteric gland, ... 54
3. Scrofulous pus from a lymphatic gland, ... 54
4. Tubercle corpuscles from the peritoneum, ... 54
5. Simple and compound cancer-cells, from a cancerous duodenum, . . 59
6. General emphysema, after a wound of the chest, ... 93
7. Portion of the web of a frog's foot, after the application of alcohol, . . 96
8. Two vessels coated with exudation granules, ... 97
9. Tongue swollen from inflammation, ... 102
10. Acute œdema of the glottis, ... 103
11. Granular exudation in the intervascular spaces, ... 103
12. Reticulated arrangement of the corpuscles of inflammatory blood, . 111
13. Plastic corpuscles and filaments in recent lymph, ... 118
14. Exudation assuming the form of pus, ... 118
15. Nuclei developing into fibres, ... 119
16. Cells " " " 119
17. Perfect fibrous tissue, ... 119
18. Compound granular corpuscles from cerebral softening, ... 120
19. " " " acted upon by pressure, ... 120
20. False membrane of croup, ... 121
21. Corpuscles in pus, ... 124
22. " " shown upon a scale, ... 124
24. Corrigan's small cautery iron, ... 161
25. The ordinary actual cautery irons, ... 165
26. Fibro-plastic and fusiform cells of recent exudation, ... 177
27. Ideal section of a granulation, magnified 200 diameters, . . . 177
28. Danger of delaying incision in paronychia, exemplified, ... 186
29. " " " " shown on the bones, . 186
30. Communication of an abscess with the carotid artery (Mr. Liston's case), . 187
31. Bubo being incised, ... 188
32. Abscess being opened from without inwards, ... 189
33. Example of fistula in perinæo, ... 199
34. Healthy ulcer, cicatrizing, ... 209
35. The weak ulcer, ... 212
36. The scrofulous ulcer, ... 215
37. The cachectic " 217
38. The indolent " 218
39. Strapping of the indolent ulcer, ... 220
40. The irritable ulcer, ... 223

PAGE
41. The sloughing ulcer, ... 226
42. Acute phagedena, ... 227
43. Peculiar ulcer of the foot, ... 232
44. Cancerous ulcer of the scalp, ... 234
45. Complete sphacelus of the foot and ankle, ... 236
46. Gangrene after compound fracture, ... 239
47. Gangrene from improper bandaging, ... 240
48. Chronic gangrene of the feet from cold, ... 242
49. " " " from general debility, ... 244
50. Interstitial absorption of the cranium, ... 259
51. The same, with caries and necrosis, ... 259
52. Continuous absorption of ure of an aortic aneurism, 260
53, 54, 55. Microscopic secti the breast, . . 269
56. Hypertrophy or elephant 271
57. Section of a desmoid fibr 272
58. Large fibrous tumor of tl 272
59. Fat cells and granular m 273
60. Fatty tumor, cholesteaton 274
61. Structure of a fatty tumor 274
62. Lobulated lipoma, ... 274
63. Fibro-cystic structure of a cystic ast, ... 275
64. The same after addition of ace 275
65. Cysto-sarcoma, from the breast 276
66. Cysto-sarcoma simplex, ... 276
67, 68, 69. Microscopic views of sections of enchondroma, . . . 277
70. Portion of a tubercular tumor—tuberculous omentum, ... 278
71, 72, 73. Cancer cells in various stages, ... 280
74. Section of a carcinoma of the breast, ... 282
75, 76, 77, 78. Views of sections of carcinoma under different circumstances, 282
79. Cancer of the lip, ... 283
80. Secondary carcinoma, ... 286
81. Medullary tumor beneath the mamma, ... 290
82. Encephaloid tumor, ... 291
83. Fungus hæmatodes, ... 294
84. Cells from a melanotic tumor, ... 295
85, 86, 87, 88. Views of sections of colloid cancer, ... 297
89. Exploring trocar and canula, ... 298
90. Section of an encysted tumor, ... 301
91. Plan of natural hemostatics in a cut artery, ... 306
92. Retraction of a cut artery shown, ... 306
93. Plan of the natural mode of hemostatics, ... 307
94. Plan of retracted artery, after incision, ... 308
95. A punctured artery, ... 309
96. The same, with the wound oblique, ... 309
97. Plan of wounded arteries, ... 310
98. Plan of a graduated compress, ... 311
99. Signoroni's compressor, ... 312
100. The common tourniquet applied to the arm, ... 313
101. The same unapplied, ... 313
102. Malan's flat tourniquet applied to the popliteal, ... 313
103. Mode of arresting epistaxis by plugging the nostrils, ... 314
104. Tenaculum, ... 316

PAGE
The spring artery-forceps, ... 317
The forceps applied, ... 317
The surgeon's knot, ... 318
Torsion forceps, ... 320
Nozzle to be used in injecting a vein, ... 322
Carbuncle shown in its common seat, ... 353
Warts on the penis, ... 356
Papilla from an epidermic growth, magnified, ... 357
Simple mucous polypi of the nostril, ... 361
Porous enlargement of the tibia, ... 371
Limited internal abscess of the tibia, ... 374
Section of the femur, great condensation, ... 375
Internal abscess of the tibia, ... 376
Large chronic abscess of the tibia, ... 377
Ulcer of the cranium, healed, ... 381
Caries in the metatarsal bone of the great toe, ... 382
Caries of the elbow, ... 384
Necrosis and caries combined, ... 384
Mercurio-syphilitic caries of the skull, ... 385
Gouge for removing carious bone, ... 386
Cutting bone-pliers, ... 386
Caries of the vertebræ, macerated, ... 387
The same during life, ... 387
Caries of the vertebra before maceration, ... 388
Sequestrum, ... 390
Necrosis of the femur, showing the sequestrum, ... 392
The sequestrum detached, ... 392
133, 134. Necrosis of tibia, in different stages, ... 395
Necrosis of the tibia, the dead bone exposed, ... 396
Forceps for removing sequestra, ... 404
Bone corpuscles, normal and in mollities ossium, ... 410
Madame Supiot (a patient with mollities ossium), ... 410
140. Permanent curvature of the spine from rickets, ... 411
Limbs deformed by rickets, ... 412
Ivory exostosis of the os frontis, ... 417
Cancellated exostosis of the femur, ... 418
Exostosis of the great toe, ... 419
Large enchondroma, ... 421
Large osteocystoma, ... 421
Osteosarcoma, ... 422
Section of osteocephaloma, ... 424
Osteocephaloma undivided, ... 424
Osteosarcoma of the lower jaw, ... 425
Osteocephaloma contrasted with the preceding, ... 425
Osteosarcoma of the upper jaw, macerated, ... 426
Fimbriated synovial membrane of the knee joint, ... 441
Diseased articular cartilage, magnified 240 diameters, ... 445
156, 157, 158. Microscopic views of diseased articular cartilage (Redfern), 445–6
Wasting of muscles and elongation of limb in coxalgia, . . . 450
Luxation of hip, from morbus coxarius, ... 450
Effects of advanced morbus coxarius, ... 451
Destruction of cartilage in the knee-joint, ... 453

PAGE
163. Chronic ostitis, from chronic rheumatism, ... 460
164. 165. 166. Changes in the form and structure of the head and neck of the femur and acetabulum, ... 461
167. Comparative view of this cause of shortening of the limb, . . . 462
168. The same femur isolated and divided longitudinally, ... 462
169. Formation and connection of loose fibrous bodies in the joint, . . . 463
170. Articular caries of the hip-joint, ... 467
171. Cure of morbus coxarius by anchylosis, ... 467
172. The same, divided longitudinally, ... 467
173. 174. Complete anchylosis of the knee-joint, ... 470
175. Enlarged bursa on the patella, housemaid's knee, ... 476
176. Microscopic appearance of atheromatous deposit, ... 481
177. Arterial degeneration a[illegible] 482
178. True aneurism of the a[illegible] 483
179. Aneurism of a double c[illegible] 485
180. Aneurism by dilatation, [illegible] 489
181. Aneurismal pouch, rup[illegible] 491
182. Section of a cyst or absc[illegible]ery, ... 493
183. Carotid of a dog, 48 hou[illegible] 499
184. " " 9 days 499
185. " " 96 hours 500
186. " " 13th day " 501
187. " " 12th day 501
188. Establishment of collateral c[illegible] 501
189. Principle of Hunter's operation illustrated, ... 506
190. " Brasdor's " " 506
191. " Wardrop's " " 506
192. The clamp for treating aneurism by compression, ... 508
193. Dr. Carte's instrument for compressing the femoral at its lower part, . 508
194. " " " " " upper " . 509
195. Varicose aneurism, ... 520
196. Outline of varicose aneurism, ... 521
197. Outline of aneurismal varix, ... 522
198. Section of erectile tumor, ... 523
199. Erectile tumor in the neck, ... 525
200. Arterial varix in the palm, ... 528
201. [illegible] 530
202. [illegible] of the leg, ... 535
203. Operation for obliterating varicose veins, ... 538
204. Section of a neuroma, ... 551
205. Microscopic section of a painful subcutaneous tubercle, ... 551
206. Fibrous structure of a neuroma shown, ... 551
207. [illegible] mass of a [illegible], ... 552
208. [illegible] tubercle on the forearm, ... 553
209. [illegible] 557
210. [illegible] interrupted suture shown, ... 557
211. The twisted suture, ... 563
212. The quilled suture, ... 564
213. The [illegible] suture, ... 564
214. Head of the rattlesnake, ... 576
215. Poison fang of the rattlesnake, magnified, ... 576
216. Bandage, ... 592

PAGE
Tenotomy-knife, ... 594
Burn on the neck. Deformity caused by contraction of the cicatrix, . 607
Longitudinal section of a fractured spine, ... 612
Partial fracture, with bending of the femur, ... 613
Impacted fracture through the trochanters, ... 614
223, 224. Fractures of humerus, at different stages, ... 617
Longitudinal section of a fractured tibia, ... 618
Section of the humerus, showing a double fracture united, . . 618
" " " " reparation after partial fracture, . 619
The long splint for fractures of the thigh, ... 621
The same applied, ... 621
Compound and comminuted fracture of the leg, ... 626
Diastasis of the femur, reunited, ... 629
Ununited clavicle, ... 630
False joint in the forearm, ... 630
Dislocation of the shoulder, ... 636
" " elbow, ... 637
Changes subsequent to dislocation of the hip, ... 639
The clove hitch, ... 641
Mode of reducing dislocation, ... 641
Compound dislocation of the astragalus, ... 644
Bruise of the scrotum,—a form of hæmatocele, ... 651

ELEMENTARY DISEASE.

CHAPTER I.

CONSTITUTIONAL AFFECTIONS IN SURGERY.

nstitutional Diseases are those which, from the variety and
er both of the phenomena they display and of the organs and func-
they involve, must be ascribed to some cause or causes acting
sively upon the system, rather than on any particular part. Such
ions lie chiefly within the province of the physician, but a know-
of some of them is also indispensable to the surgeon. Because,
ugh his chief business is undoubtedly with local diseases, and local
dies, it is found to be constantly the case that these are mixed up
constitutional affections, either pre-existent or secondary, the re-
ition and management of which are often all-important to his suc-
in dealing with the local disorder. The following chapter will
fore comprise a number of general principles in relation to consti-
nal diseases, which cannot be safely dismissed from the mind of the
itioner, in dealing with even the simplest surgical case; and which,
lation to a great number of the more complicated instances of injury
local disease, have an importance very apt to be overlooked by those
have been taught to consider surgery as an art standing by itself,
capable of being practised without a competent knowledge of the
r art of medicine.

is indeed very evident, on the slightest reflection, that the issues of
h and life could seldom depend on the operations of the surgeon,
for that wonderful connection between each part and the whole, be-
n the circumference and the centre, which it is the object of this
ter to unfold, and to which every department of surgical practice
ishes abundant testimony. The removal of an arm or leg, the severe
y or even gangrene of some external and unessential part, could
r be attended by fatal results, in so large a proportion of cases, but
aws of the economy to which the investigation of local diseases can
r guide us. In every inflammation, whether external or internal, these
are in action; and the history of injuries, apparently the most trivial
gards the part directly affected, often teaches us the lesson, that the
an body can by no means be regarded as a piece of machinery, in
h what is not essential to its working may be at any time destroyed,
emoved with impunity.

There are two channels by which, according to physiological science, a communication is established between all the different parts of the human body; two systems of organs, which are so extensively ramified throughout the body, as to deserve to be called universal. These are the circulation and the nervous system—the vessels and the nerves. It is therefore highly probable, that the influence of constitutional conditions in local affections, or, conversely, of local injuries and diseases in the system at large, is produced by one or other of these channels; either by some modification of the constitution of the blood, or by some impression on the nervous system. In the attempt, however, to determine the particular share which each of these causes has in the production of any one disease, the greatest disputes have arisen among medical authorities; the *Solidis* een called, usually ascribing most to the influence of n upon the tissues; while the *Humoralists* have rega the main source of nearly all diseases. In the prese lisposition to harmonize these two doctrines; the prog cal knowledge having shown, in a very clear light, the on of the functions of circulation and innervation thro organism. And, accordingly, exclusive solidism and disappeared from modern pathology.

In a practical treatise, , it seems advisable to adopt well-marked symptomatic ier than controvertible pathological doctrines, as the basis of cla on. And we shall, therefore, consider the constitutional affections with which the surgeon has chiefly to do, according to their most prominent characters as observed in the living body.

The first class will comprise the *Fevers;* perhaps the most important, and widely distributed, of all constitutional disorders. They are distinguished by the presence of increased rapidity of circulation and heat of surface, together with a variety of other derangements of the nutritive and assimilative functions, and of the nervous system.

The second class will embrace a large number of diseases, characterized by the presence of very various kinds and degrees of derangement in nutrition, secretion, and assimilation—and sometimes in the nervous functions; but without marked, or at least constant, febrile excitement of the circulation. These we may call *Cachectic Affections.*

The third class is that of *Affections of the Nervous System;* distinguished by prominent implication of the functions of the nervous centres, and by the comparatively slight character of those derangements of the organic functions, so marked in the other two classes.

To these will be added a few important considerations, on affections of internal organs as connected with surgical disease; thus completing, at one view, what may be called the *Principles of Surgical Medicine.*

FEVERS.

The term Fever (*febris*, from *ferveo*, I grow hot) is applied to a condition of the system, in which there is increased heat of the surface preceded by shivering or chilliness, together with more or less exciteıt of the circulation; the pulse being above the natural standard in quency, and also generally altered in its other characters. To these ıptoms are invariably added derangements of other functions, the ree and kind of which vary with the type and stage of the fever, but ch are always so extensively distributed, and so marked in character, o render evident the constitutional nature of the affection. Perhaps most general of all these symptoms is a feeling of debility and op-ssion; which, with various modifications, marks the whole course of disease in almost every instance.

Vhen we look at the affection more in detail, we find that it usually lves itself into three distinct stages; of invasion, progress, and reso-on. The first accession of the disease is marked, in some cases very inctly, by a rigor, or shivering fit, of short duration; in others only htly, by chilliness, with a sensation of general and undefinable dis-fort and anxiety, which may be distributed over several hours. The ace is pale, and rather cold (though seldom in this respect corre-ıding to the sensation), and often presents the roughness and peculiar called *cutis anserina*, or goose-skin. The appetite is defective; e being sometimes nausea, sometimes mere indifference to food. The e is small and frequent; and a sensation of weariness and languor bines with some degree of soreness in the muscles, to render exertion ressive and painful.

'rom this stage springs the second, in which the pulse becomes nger and harder, the surface preternaturally warm, the face flushed, appetite still farther diminished or lost, the thirst extreme, the gue loaded with a fur, and the bowels constipated. This stage may many days, or may terminate in a few hours. Throughout it the etions are diminished, especially the cutaneous transpiration, which uch altered, rendering the skin hot and dry. There is general las-de with prostration, and the mind is more or less oppressed, while sensations may be preternaturally acute, sound and light being ill ıe, as well as every other source of disturbance. Along with these ptoms there is generally some degree of headache; and pains in the s continue, although the anxiety and sense of general weariness are always so great as in the first stage. There is likewise marked ciation, more or less rapid, according to the intensity of the fever.

t the termination of the second stage, moisture returns to the skin, frequently a copious perspiration breaks out. The other secretions he same time increase; the urine, which had been scanty and high red, throwing down a copious sediment. The pulse then subsides to ıatural standard, the appetite returns, and all the symptoms gradu-disappear. The period at which these signs of improvement com-ıce, is called the *Crisis* of the fever.

n these phenomena, which are common to all well-marked fevers, we observe the presence of an altered state of almost all the important ctions; derangement of the nervous centres being indicated by the uliar febrile sensation and prostration, often with increased sensibility general pains; the circulation being altered, as regards the charac-of the pulse; digestion in abeyance; secretion much diminished; le the nutritive and respiratory functions seem to expend themselves in the production of increased animal heat—the tissues gradually wasting away under the influence of the disease. From this very general prevalence of functional derangement it has happened, that different pathological writers have attempted to fix the seat of fever in the viscera of the head, thorax, and abdomen. But as the result of all these attempts, it may be stated, that no symptoms or lesions have been found sufficiently constant, in character or seat, to enable us to ascribe a local origin to this disease, in its simplest form. As it occurs to the physician, it is often found to exist, without any corresponding organic derangement being discovered after death. As known to the surgeon, it is most commonly a symptomatic affection; but symptomatic, indifferently, of lesions in all p[illegible]nd of the most various orders. On the whole, perhaps [illegible] and invariable of the phenomena of fever, are su[illegible]hange in the function of the capillary vessels through[illegible] But the nature of this change is quite a matter of spec[illegible]annot safely assume that the capillaries of the surface[illegible]ect, a complete index of the state of the circulation [illegible]ave, however, in the altered nutrition and secretion, t[illegible]al heat, and the emaciation of fever, a sufficiently clea[illegible]rangement of the processes carried on in the capillaries. [illegible] system, also, may be involved more or less in all these chang[illegible] be even the primary medium of their production. On the other [illegible] the quickening of circulation is probably only a symptom, and, though in this light of the utmost importance, certainly bears no very characteristic relation to the other and more dangerous functional disorders which are to be looked upon as the source of the disease.

Such is the general description of fever; a condition almost as frequently met with in surgical as in medical disease. It varies extremely in its details, as to symptoms, causes, and treatment. It is sometimes a general affection from the first, being then called *Idiopathic;* sometimes a consequence of local affection, in which case it is said to be *Symptomatic.* Both these forms may fall under the notice of the surgeon, in connection with external diseases; the fever being in the one case the cause, in the other the effect. Again, it not unfrequently happens that fevers may, in the first instance, be caused by some external lesion; and may react upon the organism, so as to produce other and quite different local phenomena. Instances of this will be adverted to hereafter.

The varieties of fever which chiefly fall under the notice of the surgeon, may be considered under the following heads:—*Inflammatory Fever* is found in connection with local inflammations, and is symptomatic of a certain degree of intensity in the local derangement. It is characterized by great acceleration and strength of the circulation, and marked increase of the animal heat; while the other derangements are usually comparatively slight in character. *Typhoid Fever* is marked by prominence of the nervous phenomena; great depression and prostration, often delirium and coma, frequent and weak pulse, and very slight increase of heat of surface; the symptoms soon passing into those of pure depression. *Hectic Fever* is characterized by periodical remissions and exacerbations, with profuse sweating; always distinctly symptomatic;

racted in its duration, and presenting considerable variety in its nomena. *Irritative Fever* may be regarded as an irregular form, essing many characters of all the other three.

he phenomena and practical relations of these varieties, it will be er to review separately.

1. *Inflammatory Fever.*

his presents every feature of the febrile condition, in a very marked . The premonitory symptoms of coldness and shivering are usually decided, but they are not of long duration; and are succeeded by ge of reaction, in which the accelerated and hard full pulse, thirst, increased heat of surface, are so great in comparison with the other ptoms above noticed, as to indicate excitement of the sanguineous em as the most prominent characteristic of this type of fever. The etions, and even the appetite, may vary comparatively little from the nal condition; and, accordingly, the exhaustion and emaciation pro- d, in a given space of time, are much less than in the other forms h will be presently described. The fever is pre-eminently that of ng reaction and vascular excitement; it presents few fluctuations or issions; its accession and crisis are usually very distinctly marked, latter being accompanied in the great majority of cases by sweating; the return to health is usually satisfactory and rapid, when the e of the disease has ceased to act. It is to be recollected, however, there is no absolute line in nature between this and any other type ver; and that, moreover, the purest inflammatory fever, when pro- ted beyond a certain period, is sure to undergo alteration into some r and more fatal type of febrile disorder.

s observed in connection with surgical practice, pure inflammatory r is always a secondary affection; consequent on some local dis- ance, of the kind to be hereafter described as inflammation. In this t of view, it occupies also a large share of the attention of the physi- . It should be constantly borne in mind, however, that some forms ver present many of these characters, which are nevertheless not to raced to any local cause; and these (which form the group *Synocha*, escribed by Cullen) may be of a contagious or even epidemic cha- er. Such an affection may occasionally give a complex character rgical disease; communicating to a trivial local affection an appa- significance, which might readily mislead an inexperienced or formed practitioner. Hence the importance of a detailed and tical acquaintance with the different forms of fever, whether idiopa- or symptomatic.

nflammatory fever begins with the symptoms of depression already ced; the patient feeling much discomfort, and yet unable to specify ailment. A rigor, or fit of shivering occurs, followed by a sensa- of much heat over the whole surface. This is the harbinger of tion; the mark—and a practical one of great importance—that the ulation has shaken off the temporary depressing influence, and is ing itself into energy of action. Then it is that remedies are of t avail. That opportunity, well taken advantage of, is usually at once decisive of a fortunate issue; but permit it to pass unemployed, and the same remedies, augmented even tenfold, may fail to avert disaster.

It is convenient to consider the disorder of the general frame according to its Systems.—1. *The Nervous.* There are aching dull pains in the loins and limbs; there is restlessness, and with much discomfort a variety of posture is practised in vain search for ease; both the will and the power of exertion are diminished; anxiety, or foreboding of evil, is felt, and its expression is given by the features; the head generally is hot; at first, special sensation is exalted; by and by, the intellectual functions are more or less disturbed; ultimately delirium is established, and coma may ensue; the face is flushed, the eyes suffused, the skin hot and dry.—2. *The Vasc* re is chiefly indicated by the pulse. It is increased in ng from 80 to 130 or more; and the heart's action is d. The pulse is hard, rolling like a cord below the fi ut little to its pressure; the arterial coats are exerci nount of tonicity, and resist the sanguineous impulse uch resistance is unequally exerted at different poi larity of movement in the artery, and thus a thrill to the finger. There is increased fulness, as if the enlarged, and held a larger quantity of blood at each art is acting not only more rapidly but more powerfully h; the circulation is truly accelerated.[1] Such are the teristics of the inflammatory pulse; frequency, hardness, thrilling, fulness. The three first are seldom if ever absent; but the fourth may be wanting, and the pulse may be small instead of full. This modification is chiefly observed during serious inflammatory action affecting important internal organs; more especially those situated in the abdominal region. And hence it is in practice sometimes termed the abdominal pulse; the artery resembling a hard thrilling thread, rather than a cord. This pulse always exists in connection with great nervous depression, and debilitated through rapid cardiac action; to which circumstance its smallness is probably due. In affections of the brain, on the other hand, producing coma, the pulse is commonly slow and full; the suspension of cerebral influence appearing to diminish the rapidity, without affecting the force, of the heart's action. There are idiosyncrasies also to be taken into account. The pulse may be naturally slow or rapid—50 or 90; and this must be allowed for, when previous inquiry has satisfied us that the patient is the subject of such peculiarity.—3. *The Respiratory.* Respiration is quickened; the breath is felt to be hotter than usual; and an oppression is complained of in the chest.—4. *The Digestive.* The tongue may vary in its appearance. It may be loaded, white, and moist; or the edges and central tip may be red and dry; the latter is probably the more frequent combination. In peculiar, and as they are called typhoid cases, where depression is great, and the nervous system much engaged, the tongue is dry, and of a brown color in the centre. There is thirst,

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[1] Mere frequency of pulse is not a proof of increased rapidity of circulation; the heart's action may be weak as well as quick; it often is so (but not in inflammation), propelling the blood more slowly than in health. To expedite the flow, it must act not only more quickly, but more forcibly than in the normal state.

lly very troublesome, with nausea, loss of appetite, sometimes vomit-
and often tenderness of the epigastrium; the bowels are constipated.
The Secerning. The secretions and excretions in general are
rially diminished. The bowels, we have seen, are constipated—
ly from want of mucous secretion from their lining membrane; the
is hot and dry; the mouth is parched; the urine is scanty, high-
red, generally acid, sparingly aqueous, and holding much saline
er, with comparatively little urea, in solution—6. *The Nutritive.*
stion is interrupted; so is assimilation; as the fever advances, so
emaciation; and strength is more and more prostrate.

uch are the ordinary symptoms of inflammatory fever. The more
ise the action, and the more important the part involved, the more
lly and formidably are they developed. They also vary according
e natural temperament of the patient. They may remit; nay, often
at one time increased, at another mitigated; exacerbation usually
eral, remission matutinal. But they never undergo an actual inter-
ion; therein resembling the local symptoms of the malady.

aving reached a certain point of intensity, the symptoms may de-
, like the local action which caused them. The pulse becomes less
, full, and frequent; the heat and thirst diminish; strength and
tite begin to come again; and the secretions reappear. Not unfre-
tly, such amendment is ushered in, if not at least partly caused, by
en and great exaltation of the secernent function—so marked, as
lly to be termed *critical.* The patient is bathed in a profuse and
ined perspiration. Or diarrhœa occurs. Or the urine flows copi-
; more aqueous; less saline; at each evacuation less and less
red; and, on cooling, letting down a large quantity of sediment—
nbling brick-dust, and hence termed *lateritious*—composed chiefly
ate of ammonia, more or less colored by purpuric acid. Hence, the
of the urine comes to be important to the practitioner; scantiness,
entration, and want of deposit denoting persistence of the symp-
; profuse flow and copious sediment, declension. Or a discharge of
d takes place; by the rectum, the urethra, the mouth, or the nose—
rding to the part affected. This is not unlikely to frighten the
ent and his friends, and may alarm the practitioner. But the latter
ighly culpable who, from such alarm, rashly interferes to stop the
. His duty is to watch the event; withholding his hand, unless the
ding should threaten to prove excessive. Such critical evacuations
discharges are usually preceded by rigor and exacerbation—then,
let the practitioner wait, and beware of officious meddling; and are
wed by marked relief of all the symptoms.

ut these, instead of declining, may advance; and, combining per-
nce with intensity, may cause a fatal result. Protracted exercise
muscle ultimately exhausts the irritability of that muscle, which then
es to obey its stimulus. In like manner, excitation of the general
em, if both great and prolonged, is certain to wear out the powers
hat system; and the patient sinks in consequence.

r the symptoms neither simply decline, nor simply advance, but
ergo change. 1. On the occurrence of suppuration, profuse and
-continued, or in an internal and important organ, or in a patient

previously much debilitated, they change their character; assuming the form of Hectic fever. 2. On the occurrence of mortification over a large surface, or in an internal and important part, or in a worn frame, they change to the Typhoid form; tending to fatal collapse.

2. *Typhoid Fever.*

This name is applied to a type of fever differing from the inflammatory, in the minor amount of reaction, in the greater degree of prostration of the nutritive and secreting functions; and characterized, above all, by very marked disturbance of the function of the brain, and secondarily of the entire nerv ght be expected from these characters, it is a very f The functions most important to life are deeply fever be protracted, a fatal result is certain; eith ing of the circulation and animal heat, or by deep. pressed respiration; or, as is not unfrequent, by a c two conditions.

In its purest form, ty y never occurs, except in consequence of some cau specific nature; and it has generally been ascribed t me substance, known or unknown, as a poison into y cases, this view is borne out by the fact of its bein ous; and it will afterwards be seen, in the conside wounds, that several of the animal poisons have the power of producing his condition of the system in a very aggravated form. Some of the purest examples of it, also, are found among the fevers which fall under the care of the physician; being unconnected with injury, or, indeed, with local disease of any kind. And such fevers are very generally contagious, or communicable from the sick person to others in his neighborhood; either by actual contact, or, as is more commonly the case, through the medium of the atmosphere.

Typhoid fever is ushered in, like the inflammatory type, by premonitory chills and shiverings, and by a feeling of general discomfort; but its approach is often very gradual, and the premonitory symptoms may be spread over two or three days. There is, moreover, a much less rapid and violent change from this stage to that of reaction, than in inflammatory fever; and it is worthy of observation that the premonitory symptoms, and the commencement of reaction, do not always in the typhoid, as in the inflammatory form, *follow* appearance of the local symptoms, but may *precede* these for some hours or days. Furthermore, the reaction, when established, is characterized by a peculiar appearance of oppression and torpidity of intellect; the eye is dull and suffused; the muscular strength is very greatly depressed; and the heat of the surface is only slightly raised—often scarcely above the natural standard. The pulse is accelerated, but does not commonly number much above 100. And after the disease has made some progress, the pulse becomes very soft, and sometimes small, affording a marked contrast to the full, hard, and bounding pulse of inflammatory fever. The tongue, which in the beginning resembles that of inflammatory fever, becomes, as the case proceeds, more and more dry; the white fur on its surface changes to a

brown crust, of the color of mahogany, dry and leathery to the
and presenting transverse and longitudinal cracks and furrows.
eeth and gums are likewise often covered with brown *sordes;* the
ite is completely prostrated; the thirst is not always considerable.
, of all the symptoms, the most remarkable and the most momen-
re those connected with the nervous system. In the beginning of
ver, disorder of the cerebral functions is chiefly observed in the
shness and oppression before noticed; the patient seems abstracted
nciful, his mind being equally incapable of continued activity or
. There is usually some headache; but very often no complaint
le, unless questions are asked. In severe cases, there is more or
omplete sleeplessness; and, in almost all, sleep is disturbed and
dreams. When to this is added incipient delirium, the affection
ming a formidable aspect. At first, the delirium is chiefly ob-
l at night. It may be active and furious; but, most commonly,
e form of unintelligible muttering—*typhomania;* from which the
t may be easily diverted by speaking to him; relapsing however
is former condition, on cessation of the external stimulus. In the
ce of the disease, delirium becomes more constant, and more inco-
t; the mind cannot be so readily recalled; there is perpetual rest-
ss, and a disposition to rise from bed. Hearing may be still acute,
ps too much so; but the eyes are either unobservant or perpetually
ring. They become still more suffused; and the pupil is either
l, or, in some of the worst stages, contracted as if from opium.
arkable phenomenon of this stage frequently is suppression, or
ness, of the urinary secretion; and consequent presence of urea in
ood.

anwhile, perversion of the other functions continues. The nutri-
rocesses are totally in abeyance; and there is progressive emacia-
giving sharpness to the features, and prominence to the angles of
ones throughout the body. All reparative actions cease; the dis-
es from wounds dry up; and on the other hand, new wounds are
be formed, by sloughing or ulceration, over the sacrum, trochan-
scapulæ, and other salient points of the skeleton. The tongue
ues dry; sweating, if it takes place at all, is apt to be profuse and
sting; not critical, but very fatal in its tendency. The pulse is
reduced in force and fulness, very rapid and soft; sometimes
nitting. These symptoms usher in complete prostration; which
be directly fatal.

other and perhaps more common mode of death, is continuance of
ration with *coma.* The nervous system, its irritability exhausted,
s into comparative repose; a repose, however, which is not restora-
but destructive to life. The delirium ceases altogether, or becomes
ally supplanted by increasing torpor; the breathing is stertorous;
tools and urine are passed involuntarily; the pupils may be more
s dilated; and insensibility is complete. Slight restlessness may
nue; but the movements are purely automatic in character; the
rs being employed in picking the bed-clothes; the lips in forming
culate sounds, or in confining the breath, which passes slowly and
y, puffing out the cheeks in expiration. These signs portend ap-

proaching dissolution; respiration becomes slower and slower, and finally ceases; and the heart's action is suspended, either simultaneously or very soon afterwards.

On the other hand, a return to health may take place, at any period of the affection; and is denoted by gradual subsidence of the pulse, together with moistening and cleaning of the tongue; and, above all, by cessation of the delirium, and the occurrence of sound natural sleep. The skin becomes moist; but there is seldom a profuse critical sweat, as in inflammatory fever; and the more protracted the disease has been, there is less of the tendency to a distinct crisis, by perspiration or otherwise. The urine may, indeed, and usually does, throw down a sediment of urate of ammonia du of convalescence; but this sediment is also not u ing nearly the whole course of the disease.

The affection thus d connection with many local maladies, to be hereaft present a marked and pure form from the beginnir commonly the case, it may supervene upon an affec the inflammatory type. In this case, transition fro accomplished so gradually, as to mark them both as e process.

The preceding types of fever, though they differ from each other in many points, are alike in respect to their *continued* character; febrile excitement remaining present throughout the disease, and subject to no remission—or only to remissions and exacerbations so very slight and ill defined, as not to form a characteristic symptom of the affection. Hectic fever is distinguished from both, by its frequent remissions and exacerbations, usually periodical, and occurring once, or sometimes twice, in the twenty-four hours; by the sweating which attends its paroxysms, causing great exhaustion and emaciation; and also by frequent recurrence and long continuance of the febrile state, without that marked disorder of the assimilative or nervous functions, which accompanies continued fever of similar duration.

Hectic fever is invariably connected with some severe organic disturbance, or change of structure; and is the form of constitutional affection which most constantly accompanies profuse suppuration, especially in an important internal organ. It is under such conditions also, that it assumes its most characteristic aspect; and has the most distinctly *periodic* exacerbations and remissions. When it is fully formed in the course of such local affection, the patient has usually at least one daily paroxysm or febrile exacerbation; often preceded by chilliness, if not by shivering; and attended by great heat of skin, flushing of the face, and burning sensations in the palms of the hands and soles of the feet. The pulse is frequent, but irregularly so; and usually subject to quick excitement by exertion, emotion, food, or any other disturbing cause. It is scarcely ever hard and full, like the pulse of inflammatory fever, nor so small and compressible as that of the typhoid; but holds a middle and variable place, in these respects, according to the degree of exhausthe patient, and the amount of febrile reaction. This state does t more than a few hours; and then subsides by a critical sweat, so e and exhausting as to be justly termed *colliquative*. Or the may be superseded by diarrhœa; which is even more dangerous system. The urine does not differ from that of inflammatory The tongue may be a little dry during the paroxysm, which is panied by great thirst; but becomes moist again so soon as the fit . The eye is free from suffusion; and flushing of the face is limited to a spot in the centre of the cheek, the color of which sts strongly with the general pallor.

se febrile paroxysms occur almost invariably towards evening, ng their height about midnight, and passing into the sweating early in the morning. The intervals, in the early stage of the n, are not unfrequently free from fever. Occasionally, however, re slighter exacerbations; sometimes irregular in character; often g to be determined by the taking of food. In the advanced stage, s nearly constant; but evening exacerbations and morning sweats characteristic of it to the end.

withstanding the great and constantly increasing emaciation— may be ascribed to the loss of nutritive fluid, by the suppuration er discharge—the appetite and assimilative functions are compa- y little affected; at least in the less advanced stages of the disease. mes, it is true, there are exceptions to this; but it is when the ative organs are directly involved, as in many of those cases of fever falling under the notice of the physician. In the ordinary of hectic, connected with external disease, the appetite continues; od is taken, during the remissions, with considerable relish. The may be natural in appearance; or it may present a slight fur, ed edges; often it is preternaturally clean and glistening, as if d with some fine membrane; it is rarely much loaded; and never ently dry and rough as in typhoid fever. The bowels are fre- y constipated, as in other diseases implying protracted confine- o bed; but, not unfrequently, they are natural; or there may be ea, as just mentioned.

exemption of the nervous centres from participation in the general er is, perhaps, a more striking character of hectic, as compared yphoid, and even inflammatory fever, than almost any of those yet ned. Throughout the whole course of the affection, the mind may perfectly clear; not uncommonly, indeed, the mental faculties o be in an unusally vigorous and active condition, even when the s very debilitated. In the intervals of the paroxysm, the patient procures sound and refreshing sleep; and even when fever has e constant, the harassing watchfulness (*pervigilium*) of the typhoid very rare. Sleep may, it is true, be light and frequently broken; is obtained in sufficient quantity to preserve the cerebral functions ate not far differing from that of health.

duration of hectic may be almost indefinitely protracted; espe- when the intervals of the paroxysms are tolerably free from febrile nent. When, however, the fever is constant, when sweating is ive, and when there is profuse suppuration or other discharge, progress to a fatal termination may be rapid. Emaciation proceeds to the last stage; the features assume a shrunk, withered aspect; the eyes are sunk in the orbits; all the bones are prominent; the flushing subsides into a pallid leaden hue; and the whole expression is that called, by old authors, the *facies Hippocratica*—the sure sign of approaching dissolution. Death is usually by pure exhaustion; the pulse and respiration ceasing very gradually, and the mind often remaining unclouded almost to the last.[1]

4. *Irritative Fever.*

The fevers known to the surgeon are not all comprised under the preceding descriptions. [illegible] typhoid, and hectic types are connected, in the majo[illegible]ses, with grave local lesions of structure; not less diff[illegible]re than the fevers themselves, though all partaking n[illegible]nflammatory character. Thus, in inflammatory fever, [illegible]or a local morbid action, of the simplest and purest in[illegible] In the typhoid, he suspects some cause whereby the [illegible]vely vitiated; and usually finds it in some putrescence, [illegible]he fluids in contact with the inflamed part; or in some [illegible]ntagious, epidemic, or endemic cause of disease. In hec[illegible] seldom that he fails to observe some chronic organic chan[illegible]hausting discharge of a suppurative kind, lying at the root of the evil. In many cases, however, neither the local lesions, nor the fevers accompanying them, can be said to present such definite characters as have been described. Intermediate forms are by no means rare; and it is not uncommon to find a fever, which has begun in a purely inflammatory form, degenerate into typhoid or hectic; the local lesion undergoing collateral and corresponding changes. Thus, if a local inflammation assumes a gangrenous character, the constitutional affection invariably becomes more or less typhoid; and if, on the contrary, profuse and exhausting discharge be established, for some time, in a part originally simply inflamed, the fever with equal certainty verges to the hectic form. Not unfrequently, from causes such as are here indicated, the inflammatory or typhoid fever may have a marked, though irregularly remittent type—indicative of the presence of a cause of hectic symptoms; or the hectic may, in turn, present the nervous phenomena of the typhoid form.

But, apart from these varieties, there are frequently witnessed in surgery fevers of an irregular character, from their outset to their termi-

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[1] I cannot resist appending a beautiful description of some of the more striking features of this disease, from the non-professional pen of a most close and skillful observer of nature—in all her varied phases and forms:—" But there were times, and often too—when the sunken eye was too bright, the hollow cheek too flushed, the breath too thick and heavy in its course, the frame too feeble and exhausted, to escape their regard and notice. There is a dread disease which so prepares its victim, as it were, for death; which so refines it of its grosser aspect, and throws around familiar looks, unearthly indications of the coming change—a dread disease, in which the struggle between soul and body is so gradual, quiet, and solemn, and the result so sure, that day by day, and grain by grain, the mortal part wastes and withers away, so that the spirit grows light, and sanguine with its lightening load; and feeling immortality at hand, deems it but a new term of mortal life—a disease in which death and life are so strangely blended, that death takes the glow and hue of life, and life the gaunt and grisly form of death."

; and accompanied by lesions either not inflammatory, or so dif-
from the ordinary forms of inflammation, as to require a different
)tion, and to imply very different methods of cure. Such fevers
ommonly a more or less remittent character; but the paroxysms
ot the regular recurrence of those of hectic; nor are they accom-
by the profuse sweats which characterize that affection. The
condition may present strong reaction, and in all its phenomena
ch the inflammatory type; or it may be accompanied by symp-
f unusual exhaustion and debility, the pulse being small and weak
often seen in the case of diffuse areolar inflammation, hereafter
lescribed. On the other hand, the nervous phenomena of typhoid
nay be absent; as they are in the majority of cases. Or we may
light paroxysmal delirium; or furious excitement, even verging
ma; the former being usually observed in persons of an hysteri-
excitable constitution; the latter, in those whose nervous system
t both activity and power, by irregular habits and the use of alco-
rinks. Finally, the fever may be of protean character; shifting
from one to another of these types, under the influence of casual
nent, or of the exacerbations and remissions of the local affection;
ienced by remedial agents—which, in these circumstances, are
to be peculiarly difficult of right application, and peculiarly
rous in their results.

uch fevers, as a class, when occurring in surgical practice, the
Fevers of Irritation, or *Irritative Fever*, is usually applied; more
purpose of distinguishing them by some neutral term, from the
of distinctly specific type, than from any sufficiently precise idea
r pathology. This term is now so generally employed by practi-
n, that it is desirable to retain it in a general classification of
for the purposes of explanation. At the same time, it will be
om what has just been said, as well as from future observations,
e affections referred to under this title vary in character too much
lassed under any general description, or referred to any common
The special description of irritative fevers will therefore be
d.

Treatment of Fevers.

vast importance of this subject, in relation to a great number of
l diseases, demands that a few words should be said upon it here;
it need hardly be remarked, that the varying nature of the
ns which we have indicated as partaking in the febrile character,
mply corresponding varieties in treatment; and that special types
er can be properly discussed, only when they come again under
in connection with the different forms of local disease. There are,
er, certain general principles, applicable to the treatment of all
ffections, which may be with great propriety stated now.

he management of all fevers, the first object of the practitioner
be, if possible, to remove the exciting cause. When this is of a
ature, as in many surgical fevers depending on inflammation, it
requently be removed, or kept in subjection, by appropriate reme-
and then disappearance of the constitutional affection may be

counted on as certain. In the early stage of acute inflammatory fever—which does not generally, in itself, involve the constitution in such hazardous consequences as any of the other types already considered—this removal, or moderation, of the exciting cause is usually the main indication of treatment. Subdue the inflammation, by local and general means; and the fever, which is the consequence of it, will cease of itself. The treatment of such a fever, therefore, is an integral part of the treatment of inflammation; and will be considered under that subject, in detail.

But, in some obstinate forms of the inflammatory, and also, more commonly, in the hectic and typhoid fevers, the cause may be beyond our reach. In the latter, i [illegible] to be found in some vitiation of the whole system; pri [illegible] ver, and to the local affection which accompanies it. [illegible] e fever must be dealt with not as a symptom, but as [illegible] d destructive disease; the local disorder having, indee [illegible] secondary importance. It is evident that, under the [illegible] the surgeon will have to look mainly to constitution [illegible] egimen; not disregarding any dangerous severity of [illegible] it, at the same time, not allowing it to obscure his vie [illegible] ns of general management.

In following out this [illegible] ations must be chiefly regarded. In the first place, it is [illegible] tch narrowly the *type* of the fever, with a view to disco [illegible] able course and tendency; and with the view also of anticipating its casualties, by a proper general regimen and treatment. In the second place, it is desirable to avert, or lessen, individual distressing symptoms, as they occur; both for the sake of the patient's comfort, and for moderation of the disease. It is to be recollected that, to a very great extent, the treatment of all fevers is merely palliative; and that it must always be so, when removal of the exciting cause is not within our power.

In fulfilling the first and most important indication, the judicious practitioner will give all his attention to the discovery, and removal, of such tendencies as render the fever *dangerous* to life. In the words of Cullen, he will look to "obviating the tendency to death;" and, with this view, will carefully mark the general character of the symptoms and type of the fever. If these be of a highly inflammatory kind, he will not look for immediate danger; but will narrowly watch the gradual approach of symptoms of exhaustion, or the slightest tendency towards the hectic, typhoid, or irritative forms of change. If the original type be typhoid, he will be particularly solicitous about the state of the nervous functions; and will likewise observe, with anxiety, the strength of the circulation; knowing that danger arises, on the one hand, from delirium proceeding to coma; and, on the other, from prostration, so rapid as to leave no time for the exhibition of remedies. Again, if hectic be the predominant form, he will endeavor to subdue the reaction, and the immoderate sweats; at the same time supporting the strength against that gradual exhaustion and emaciation, which is the inevitable result of a drain upon the system. And lastly, in the irritative fever, he will attempt to subdue pain, and procure sleep; at the same time fulfilling such other indications as present themselves. Watching the effect nedies with care—lest the type of the affection change; and lest rhich was remedially useful, becomes powerless or even injurious.

the use of individual palliative remedies, which fulfil the second tion, he will take care to apply them only to such symptoms as much present distress, or create serious apprehensions for the ; and only in such measures as may harmonize, or at least not ere, with the general plan of treatment. He will avoid, with al care, that meddlesome and routine practice, which endeavors e with every isolated and perhaps transitory symptom, by remedies d from hour to hour; without regard to those great indications, ought to form a stable and consistent basis for all minor arrange- . In symptoms, he will regard rather the tendencies which they te, and the types of disease they represent, than their own indivi- ignification; and will direct his remedies accordingly, applying if possible, so as to accomplish at once a general and a special . At the same time, he will not fail to employ such simple means, feelings of the patient and his own knowledge induce him to con- ffective for affording relief from present discomfort, remembering, er, that there is always more danger from too much, than from too ctive interference of this kind.

treatment of individual forms of fever, upon the principles now ted, will be adverted to hereafter. But there is, perhaps, no part lical practice which requires so much the teachings of experience, s the recognition of the different varieties of fever, the detection nidable and favorable symptoms at their earliest appearance, and dicious application of remedies. Daily and hourly changes, in cases, require the most careful watching on the part of the practi- ; and even the most skilful will, at times, be foiled in the discovery e sign of importance until it has made alarming progress. The ng practical rules, however, may be of some use to the student; ey are the more important, as they will generally be found appli- o every form and type of fever:

lere acceleration of the pulse is not necessarily an unfavorable especially in fevers of the inflammatory kind, and united with reaction. But when, in fevers of typhoid type, the pulse rises s or beyond 120—more especially if it be at the same time or small, and with few of the other signs of reaction—there is great danger of prostration before the end of the attack. lly speaking, a strong reaction at the beginning of fever is indi- of a vigorous state of the constitution; and is to be regarded as ble. Cold affusion, or cold sponging of the surface, may often be ed with relief to the sensations of the patient; but further active rence with reaction is seldom beneficial; except in the case of nmatory complications, when the *antiphlogistic* regimen and required.

tration of the nutritive and assimilating functions is not rce of danger, in fevers of short duration. But, in all atinued fevers, if lasting beyond a fortnight, the danger se becomes considerable; and fevers so protracted almost nd towards the typhoid type, or some other form indicating exhaustion. Hence it is of much importance to convey into the system, from the beginning, such small quantities of the most digestible and least stimulating aliments, as the weakened assimilating powers will bear; and care should be taken, at the same time, by the occasional administration of slight aperients or purgatives, that the intestines are not unduly loaded. When the fever is protracted beyond a week, without signs of amendment, it often becomes necessary to resort to the *continuous* exhibition of wine or alcoholic liquors; which, under such circumstances, appear to act not as ordinary stimulants, but rather as easily absorbed alimentary substances. The necessity for such remedies is judged of by the state of the pulse, by the emaciation and exhaustion, and especially by the a ; a marked decline in which, without a crisis, is alwa symptom.

3. The state of the s ant guide to the exhibition of remedies. In this r transpiration, and the urine, require to be particular nomena of the critical evacuation, as observed in already been noticed. But all sweating in fever is en this symptom occurs in a protracted case, without looked upon as most unfavorable; leading to extr requiring the exhibition of stimulants. In hectic, a fevers, also, sweating may become a source of dang sustained recurrence. It is usually mitigated by to ly by dilute sulphuric acid, and quinine, in considerable doses.

Extreme scantiness of the urine, or diminution of its animal constituents, is always dangerous; being generally followed by typhoid phenomena. It is important, therefore, to keep this secretion tolerably abundant; and also not to allow it to accumulate too long in the bladder, as sometimes takes place in typhoid fevers. In such cases, it should be drawn off, as often as may be necessary, by means of the catheter.

4. The phenomena of collapse, with loss of animal heat, and small weak pulse—possibly frequent and intermitting—are always to be regarded as very formidable. They are met by the administration of alcoholic and other stimulants, especially of the diffusible kind (as carbonate of ammonia and camphor), in frequently-repeated doses; and, occasionally, the application of artificial heat to the surface may be useful.

5. The nervous system requires close attention in all fevers, but particularly in the typhoid. It is commonly not until the second week of the disorder that symptoms of this class assume a dangerous character; but at this time, also, they have in general become little amenable to control. And, accordingly, it is of the highest importance that the earlier premonitory signs should be unremittingly watched, in order that they may be counteracted while yet remedies are of avail. Among these signs none is more important than wakefulness. Unless a certain amount of truly refreshing sleep be procured, the tone of the nervous system is soon undermined. Delirium sets in; at first, in the mild form of slight wandering fancies, and incoherencies of expression; but afterwards either furious and maniacal, or low and muttering, with complete prostration of intellect; and this, again, is succeeded by stupor and

ı, as before described. To avert this formidable train of symptoms,
ractitioner cannot be too much on the alert. He will daily inquire,
tely, as to the previous night; he will observe if the eye be clear,
nswers intelligent and quick, the mind free from fancies; and if
indications of a sound working brain be not present, he will rightly
that interference is required to procure repose for the mind, and
quent restoration to its normal state. Or if there be much
ache with flushed face; if the senses be excessively acute, the
est noise or light producing great disturbance, and all external
ssions apparently heightened—in this case, also, there is need of
lest the brain be rapidly exhausted, and lest delirium, followed by
supervene.

e simplest means for counteracting disorder of the cerebral func-
in the earlier stages of fever, are the application of cold to the
by means of an evaporating lotion—the hair having been pre-
y removed; and the abstraction of all external stimuli, especially
of light and noise. When however these means fail, it will fre-
ly be proper to administer a full dose of opium; a remedy which
e given at an early period with tolerable freedom, although after-
its use requires the utmost caution. If headache and flushed
enance, with other symptoms of excitement, be predominant, a few
s may be applied to the temples; and hyoscyamus may be given,
instead of the opium, or along with it. Or the opium may be
ned with small doses of tartar emetic; which seems, in such cases,
re a valuable soothing property, at the same time reducing the cir-
on. If, notwithstanding such remedies, delirium supervene, and
a tendency to pass into coma, the secretion of urine should be care-
looked to, and the bowels kept free, by the administration of
ics and purgatives; stimulating enemata are also useful; narcotics
be suspended; and blisters may be applied to the vertex, and to
parts of the body, with the view of rousing the patient. In this
age of the disease, however, all remedies are very commonly pro-
e of but little benefit; and our main trust has to be placed on
's power of endurance, aided by cautious continuance of the
i.

e subject of Fevers, the student may consult Cullen's Practice of Physic; Graves'
Medicine; Christison, in the Library of Medicine; Tweedie, in Cyclopædia of
l Medicine; Hunter on Inflammation, Part II, chapter ix; Thomson on Inflamma-
ap. iv; Travers on Constitutional Irritation, Part I, 1826.

CACHECTIC AFFECTIONS.

he class of diseases now to be described, fever either does not
at all, or is so inconsiderable and variable in amount as not to be
teristic of the affection. They are all, however, accompanied by
or less extensive disorder of the organic functions, especially those
rition and assimilation; by various glandular affections, particularly
lymphatic system; and, not unfrequently, by vitiation of the
which can be proved experimentally to contain some deficiency or
of its normal ingredients, or some foreign substance introduced

into the system. According to the Humoralists, the *Cachexies* are essentially *blood diseases;* and some have not hesitated to ascribe the greater part of them to morbid poisons, or *materies morbi*, introduced into the blood; thence acting specifically on the different tissues. Others have expressed a somewhat similar general idea under the term *dyscrasia*, which has been applied by many continental pathologists to a defective organization, or elaboration, of the circulating fluid. Such theories, however, have little even of scientific value, in the absence of direct proof of an essential and primary lesion of the blood, such as is implied; while the habitual employment of these terms tends to restrict our ideas to one field of investigation, and to throw out of view the possible co-operation of the nervous system and the solids generally in producing such diseases. Practically, the question of the proximate cause is important, only when, by a knowledge of it, we may be enabled to isolate or remove it, or altogether to prevent its invasion; and this is the case, in some of the cachectic affections which will be noticed as the effects of morbid poisons. Meantime, we are content to consider cachexies in general according to their symptoms, without entering far into speculation as to their cause.

The number of the cachectic affections is great, and their symptoms very various. They are almost all severe and dangerous; destructive of texture, or of life; some contagious, some endemic, or epidemic; peculiar to certain localities, ages, times, ranks, and conditions of men; and most of them chronic—developed slowly over a term of months or years. Some are very amenable to treatment; others constitute the most irremediable and fatal diseases which affect humanity; and a few belong rather to the history of past ages, than to the present.

1. *Scrofula and Tubercular Disease.*

The term scrofula is usually applied to a constitutional affection, occurring for the most part in early life, of essentially chronic development, and characterized by a tendency to various destructive diseases of the bones and joints; often accompanied by enlargement of the lymphatic glands, and by disorganizing affections of the skin and mucous membranes—occurring either separately or together, and without obvious or adequate exciting cause. Under this somewhat comprehensive definition, it is obvious that a great number of different local disorders may, and indeed must, necessarily find a place; and we accordingly have the term scrofula, and scrofulous disease, applied by many writers to types of local affection which are only very indistinctly, if at all, connected with a constitutional cachexy. In the absence of more unequivocal signs of constitutional disorder (such as extensive involvement of the lymphatic system), it is therefore almost essential to the idea of scrofula, as we have defined it, that there be an association of a number of maladies, pointing to a vitiation of the general system as their common cause. This rule, however, only applies to the well-developed affections; for, in its early origin, a single local disorder not unfrequently presents such characteristic symptoms, as enable the experienced practitioner to judge with tolerable certainty of the existence of the yet latent constitutional evil.

The frequent association of scrofula with a peculiar form of morbid product, has been long observed. This deposit, which will presently be described under the name of *tubercle*, occurs very frequently in enlarged lymphatic glands; leading to a slow process of suppuration and ulceration there. It may also affect various internal organs, as the lungs, brain, intestinal and mesenteric glands; in which situations it proves the source of various destructive diseases. We cannot, however, limit the term scrofula, as some have done, to disorders arising from tubercular deposit; inasmuch as most affections of the skin, mucous membranes, and joints, in scrofulous individuals, have no such origin. Nor, on the other hand, can it be admitted that tuberculization of the internal organs, at least in adult life, is always, or even generally, a disease of the scrofulous habit. All that can be fairly said is, that tubercular disease of the external glands is a frequent concomitant of scrofula; as is also a similar affection of the mesenteric glands. And that, in a certain indeterminate number of instances, tuberculization of internal organs follows, or accompanies, the characteristic evidences of scrofulous disease; while, in others, it is quite an independent affection. Still, however, as most of the forms of tubercular disease which come under the notice of the surgeon are distinctly scrofulous, it is requisite to treat of these affections under one head.

This cachectic tendency is either hereditary or acquired. Frequently it may be traced descending from parent to child, from generation to generation. But, on the other hand, a child may be born, itself in all respects healthy, and of healthy descent both immediate and ancestral, and yet in the course of years come to show all the signs of a confirmed strumous diathesis. The circumstances likely to induce the unhappy change are those of a peculiarly debilitating tendency; exposure to atmospheric vicissitude, by insufficient clothing and shelter; improper and scanty food; lingering and wasting disease; imprudent use of mercury, especially in tender years; excessive labor, mental or corporeal; and habitual deprivation of healthful air and exercise. Or again, such events may not be the means of inducing this disorder in a frame previously healthy; but only the direct and exciting causes of it, in a system already predisposed by hereditary taint. The disease is not communicable by contagion or inoculation, as has been proved by direct experiment; and it is found to prevail more in temperate climates, as this, than in either the extremely hot or cold—variability seeming to be especially favorable to its accession. It is also more frequent in towns than in the country; as are all other diseases of debility. Males are more liable to external scrofula than females; while these, on the other hand, are more subject to phthisical disease.[1] The especial period of accession, even in those in whom the tendency is congenital, is between the ages of three and seven years; but, indeed, the whole period of adolescence is favorable to its occurrence, the normal balance of health being then more easily deranged by accidental circumstances than at a more mature age. In those of confirmed scrofulous habit, the tendency to development of diseased action varies also according to season. Spring is the period of exacerbation; more especially the month of March. This month is supposed to represent the maximum of the crisis; January and June its extremes of accession and decay.

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[1] The reader will find an able discussion of the causes of scrofula in the work of Mr. Benjamin Phillips, "Scrofula, its Nature," &c. Its tendency is to limit very much the supposed influence of hereditary predisposition in regard to this disease. In connection with this subject, also, see Dr. Walshe's Report on Phthisis, in British and Foreign Medico-Chirurgical Review for January, 1849.

The disease may be evinced by outward signs; and these have been supposed divisible into two distinct varieties, according to temperament; the sanguine and phlegmatic. According to Phillips, however, such artificial division is scarcely warranted by an extended observation of the disease; which is found to occur in all temperaments, and in almost all states of the system.

In the sanguine variet fair, and frequently beautiful, as well as the fe though delicate, is often graceful. The skin is tl nd subcutaneous blue veins are numerous, shining v the otherwise pearly white integument. The pupil ious; and the eyeballs are not only large but promi owing a lustrous whiteness. The eyelashes are long a ophthalmia tarsi exist, as not unfrequently is the c hes are wanting, and their place is occupied by the ly margin of the lid.

In the phlegmatic for is dark, the features disagreeable, the countenance ether forbidding, the joints large, the general frame sti r otherwise deformed from its fair proportions. The skin is thick and sallow; the eyes are dull, though usually both large and prominent; the general expression is heavy and listless; yet not unfrequently the intellectual powers are remarkably acute, as well as capable of much and sustained exertion. The upper lip is usually tumid, so are the columna and alæ of the nose, and the general character of the face is flabby; the belly inclines to protuberance; and the extremities of the fingers are flatly clubbed, instead of presenting the ordinary tapering form.

These characters are accompanied by others, referable to the internal organs; and which, though not distinctly morbid, generally indicate the approach of the disease. Digestion is weak and imperfect; and this is indicated, as usual, by abnormal states of the tongue and bowels. The muscles are soft, flabby, and weak; the blood is thin and watery; the general circulation denotes debility, and is liable to oft-recurring derangement; the extremities are cold; and in short there are a greater or less number of the usual indications of want of tone, and general weakness.

Added to these signs, there are oft-recurring morbid conditions, which, although not individually of great importance, yet serve collectively to point out the general functional disorder. The mucous membranes are very liable to derangement; there are frequent discharges from the nose, ears, or eyes; the tonsils become enlarged; and the air-passages inflame from the slightest causes. The stomach and bowels are more and more disordered; the tongue is generally foul; the cutaneous perspiration is said to be unduly acid, and loaded with sebaceous matter. All morbid actions too, are apt to assume a chronic and obstinate type; very different from what is observed in the healthy idual.

he disease makes progress, the cervical glands commonly become ; the mesenteric glands also are more or less affected; and y of the abdomen increases. The enlargement of the cervical is at first perfectly painless, and without any mark of increased r action. Afterwards, however, a low form of inflammation the progress of the swelling; and an abscess is slowly formed, me degree of redness, pain, and heat of the part. The tumor s and softens, presenting a rounded surface; not conical, as in te abscess—to be hereafter described. The skin, if not opened e knife, soon ulcerates; and a discharge of yellowish, curdy, id matter takes place, which consists of pus mixed with the pecu- osit of tubercle. The ulcer thus formed is slow to heal. Its of a yellow or pale-red hue, after a time produces granulations; r, pale, flabby, lowly organized and vascularized, possessed of but nsibility, and not effectual towards cicatrization. Closure advances y and imperfectly; is long of being completed; and, when com- is unstable and unsatisfactory. The cicatrix is blue, soft, and n the least reaccession of vascular excitement to be undone by on; the ulcerous part has been covered over by a film, but not aled. Areolar tissue, or any other superficial texture infiltrated rcular matter, is incapable of producing a permanent and satis- cicatrix—white, firm, and depressed. To effect this, the ed part must be removed, by the act either of the surgeon or of [1] by caustic or by spontaneous disintegration; on a firm founda- ne can the true reparative structure be raised.

when an apparently satisfactory cicatrix has been obtained, the not to be regarded as complete; for, if the constitutional vice unremoved, as too frequently is the case, disease is likely to in the original site, as well as elsewhere. In treatment, there- r attention must be directed fully more to the system than to the nd also, the constitutional care must be maintained long after of the local disorder.

nost serious complications of scrofulous disease, however, which ıder the care of the surgeon, are the affections of the bones and They generally arise from slight injuries; but still the result is uch out of proportion to the cause. They are sometimes of a character; but frequently do not differ essentially from ordinary atory affections, except in being slower in progress and more e in cure. The affections of the eye and skin, in the scrofulous, peculiar; and, with the others, will be adverted to hereafter.

rcle, the morbid deposit so often found in scrofulous glands, as in internal organs, is a substance presenting very imperfect ıtion. In its most recent form, it aggregates itself into small,

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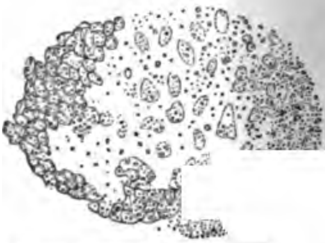
ature I always mean a certain assemblage of natural causes, which, though of reason and contrivance, are directed in the wisest manner, whilst they perform ations, and produce their effects. Or, in other words, that Supreme Being, by wer all things are created and preserved, disposes them all in such manner, by te wisdom, that they proceed to their appointed functions with a certain regularity , performing nothing in vain, but only what is best and fittest for the whole frame verse, and their own peculiar nature; and so are moved like machines, not by of their own, but by that of the artist."—*Sydenham.*

rounded, or irregular-shaped masses, not larger than a pin's head. In the lymphatic glands, these are always of an opaque yellowish color, and disposed to soften; in the lungs and other organs, they are sometimes pearly or semi-transparent, and of considerably firmer consistence. These masses become large, and confluent; at the same time softening, and assuming a yellower appearance. Finally, a considerable mass breaks down into the flaky and curdy pus before mentioned, and is evacuated.

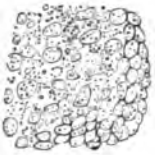
Fig. 1.



Tubercle corpuscles, and granul
rom a soft tubercular mass in the lu
Bennett.

When microscopically examined, tu-
s numerous corpuscles of a
from that of the blood-
e its bulk, slightly angular
l having a very imperfect
the cell-wall enclosing only
, without any appearance
ucleus. These corpuscles
are mixed with more or l sue of the part; and some-
times with the elements inflammatory exudations,
which will be afterwards

Fig. 2.



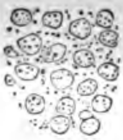


Fig. 4.

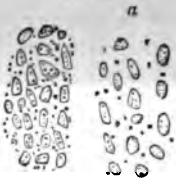


Fig. 2. Tubercle corpuscles rom a mesenteric gland. Fig. 3. Scrofulous pus from a lymphatic gland. Fig. 4. Tubercle corpuscles from the peritoneum. *a.* The same after the addition of acetic acid.—*Bennett.*

In the internal organs, tubercular deposits do not differ materially in constitution from those in the external lymphatic glands. In both situations their progress is usually the same; it is, however, to some extent modified by the nature of the part wherein the tubercular matter is deposited. In the lungs the masses of tubercle seldom attain a considerable size without softening; and as the debris of the softened tubercles is discharged by the bronchi, along with the remains of the pulmonary tissue, an ulcerous excavation results, which is usually called a vomica, or tubercular cavity. These excavations are generally formed first at the upper part of the lung; they are seldom isolated, and often break into one another, causing by their rapid extension hectic fever, copious expectoration of pus, often considerable hemorrhage, and finally death, either by long-continued exhaustion, or by some accidental inflammatory complication. This deposition and excavation of tubercular deposit in the lungs forms the chief feature of the disease known as phthisis pulmonalis, which is not unfrequently developed at all ages before the middle period of life, in persons in whom the scrofulous taint is strongly marked, as well as in many others who have given no external indications of this constitutional condition.

mucous membrane of the intestines tubercles are very fre- found; and by their softening and disintegration open ulcers luced, which in the great majority of cases undergo progressive n, and by producing diarrhœa contribute greatly to a fatal Intestinal tubercles are commonly formed secondarily to those ıngs; and are often accompanied by a tubercular state of the ric absorbent glands.

e serous membranes, especially the peritoneum and pleura, s not unfrequently form; and in these situations they have little y to soften and ulcerate, as in other parts of the body above ed. The destructive tendencies of tubercles in the serous mem- arise from their being accompanied by chronic inflammatory s, which may either be fatal directly by interfering with the al activity of important organs, or indirectly by exhaustion and

e brain and its membranes, tubercles occasionally soften and scesses; more commonly, however, they are fatal at an early their development by interference with the functions of the and in the majority of cases by producing effusion into the es, or hydrocephalus. This form of tubercular disease is most in infants and young children.

he internal, as in the external parts of the body, tubercular not unfrequently heal, or become inactive. The healing process s slow; and after ulcers have been formed, or tubercles have xtensively deposited, it is very uncertain; a stationary or retro- ondition of the affection being often followed by renewed activity gress. The healing process is rarely, if ever, accompanied by on or absorption of the tubercular masses, although these may disappear from the tissue by ulceration, and be eliminated from tem. More commonly some of the tubercular masses are found in, even after an apparently perfect cure of the affection, in the f hard, gritty, or chalky masses, generally surrounded and sepa- from the normal tissues by a fibrous cyst; and these bodies, h perfectly unorganized, may lie latent in the organs for an ite period without giving rise to any inconvenience. It is well ined also that tubercular excavations in the lungs, even when of ize, occasionally heal, either by gradual contraction and oblite- leaving a fibrous cicatrix; or by the formation of a smooth lining ane, continuous with that of the bronchi, and resembling, in some the structure of the mucous membrane.

ll the forms of internal tubercle, that of the lungs is the most nt and the most extensively fatal. It is not common, however, bercles to be present in one organ without the participation of in the morbid condition. And the surgeon will do well to keep mind when called upon to treat external tubercular affections; ally if severe operations are required. Many a patient has suffered ation of a limb, or excision of a joint, in whom the external and apparent disease was the least part of the affection, and in whom nstitution, enfeebled and destroyed by a wide-spreading disorder, ttle adapted to bear the shock of an operation. It should therefore never be forgotten that, in adults, tubercle very seldom manifests itself in any part of the body without the lungs being affected; while in infants or children, the lungs, bronchial and mediastinal glands, intestines, mesenteric glands, and the brain, are frequently the seats of this morbid deposit, which in any or all of these situations may be pursuing its destructive course while the careless or ignorant surgeon is fixing his whole attention on a gland or joint.

Treatment of Scrofula.—This is both local and constitutional; the latter the more important, as already stated. In most diseases, and especially in this, prevention will be found better than cure. When a child, therefore, is born of strumous parents, all those circumstances formerly noticed as likel [illegible] pment of the disease, a tendency towards which is [illegible] ngenital in the patient, should be most carefully avoide [illegible] dance with the view taken of the cause of the deprav [illegible] ate of system, it is plain that the line of treatment, wh [illegible] or curative, should be tonic. This best consists, not [illegible] n due regard to food, bowels, skin, air, exercise, and cli [illegible] should be in sufficient quantity, generous and nutriti [illegible] d not in such amount as to exceed the power of diges [illegible] s should be kept in a regular and normal state, by at [illegible] nd exercise; assisted, if need be, by simple laxatives; [illegible] more especially mercurials, being avoided, unless in urg [illegible] nces. Mercury is justly held to be injurious in the scrofulous diathesis, more especially when used so as to produce its constitutional effect; except when acute inflammatory action has seized upon an important and delicate tissue; and even then it must be used warily—for scrofula greatly modifies that tolerance of the remedy which inflammation would otherwise engender. Purgatives, on the other hand, are dangerous, because likely to induce tubercular deposit in the mucous membrane of the intestinal canal, or to cause softening and suppuration of deposit which may have already occurred there. The skin is kept warm, by sufficient clothing—flannel not omitted; and clean and perspirable, by daily bathing as well as ablution. The bath should be cold; and sea-water is to be preferred, when season and other circumstances are favorable. Reaction is the object of the bath; and when this fails, either altogether or in part, bathing should be abandoned; perseverance would occasion more harm than benefit, exerting a depressing and relaxing influence instead of one that is tonic. Within doors, the patient should be at all times in an atmosphere which is dry, pure, and often changed by ventilation; and exercise in the open air should be daily practised, short of actual fatigue. If possible, a climate should be made choice of which is dry, bracing, temperate, and free from sudden yet habitual vicissitude. Should the disease threaten, notwithstanding, this regimen is to be assisted by selections from the class of simple tonic medicines—bark, cascarilla, calumba, rhubarb, &c. Alkalies also, cautiously and occasionally administered,[1] are usually found of service; not only as neutralizing acid to which the patient is especially liable, but also seeming to exert a beneficial influence on the blood.

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[1] Long continuance of alkalies, it is well known, seldom fails to bring the strongest system into a state of asthenia.

here are certain remedies which aspire to the rank almost of
in this disease; and the foremost of these are the preparations
e, more especially the iodide of potassium. This medicine is
solution, in doses from gr. i to gr. iii thrice daily; watching
t, so as to avoid the somewhat violent physiological result which
nce of full doses is apt to induce. The beneficial operation
es seems to be increased by combination with cantharides. Iron,
, is much in favor; not only as an excellent tonic, but also, like
alies, as having a beneficial influence on the blood; probably
ting the red corpuscles—as well as the proportion of fibrin, in-
through its general tonic effect. Iodine and iron may be hap-
bined. The iodide of iron may be given in the solid form, or
rup; the latter is usually preferred. Sometimes it may be
combined, or alternated, with sarsaparilla—a medicine also far
lueless in the treatment of struma. The muriates of lime and
once held a high reputation, but latterly have fallen into sad,
s to be feared, not undeserved neglect. Walnut leaves, in the
extract, have also been brought prominently forward; but their
on has still to be made. Cod-liver oil is the most recent of the
d its claims have been maintained by both theory and experience.
may be expected from the proportion of iodine it contains. But
—in scrofula, it is said that "the nitrogenized elements of nutri-
in excess; the evacuations even become albuminous, and are
ke white of egg; gradually the albuminous principle of the blood
s predominant; at the same time the fatty or carbonized principle
ars, and emaciation takes place; at length albumen is deposited
textures, constituting tubercular deposits. The whole of this
is evidently one of perverted nutrition; and that this is owing to
nce of the carbonized or oleaginous elements, and an excess of
ogenized or albuminous, must be evident. The indication of cure
nder such circumstances, must be to introduce into the system the
med principle, namely, fluid fat, or oil, in order that it may com-
th the excess of albumen, and constitute a healthy blastema for
port of nutrition."[1] By whatever theory its action is explained,
no denying the fact, that this medicine is of much virtue in
ous disease; alleviating the symptoms, fattening the patient, and
ing the general tone of system. To all ages it is suitable, but
lly to the young; given in such doses as the stomach will bear,
nerally found to sit most lightly when taken shortly after meals.
mes it causes nausea, with loss of appetite; and then it must be
ined, at least for a time; the syrup of the iodide of iron, or some
ubstitute, being given meanwhile. Or other substances may not
bly supply its place; as cream, butter, fat of bacon, &c.

local treatment varies, according to the stage of advancement.
the deposit is yet recent, and the enlargement chronic and indo-
t is usually our object to effect discussion. The preparations of
are used both externally and internally, with this view; as in the
f chronic abscess; and the form of ointment, applied by friction,

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nett, on Cod Liver Oil, 1841. See, also, by same author, Remarks on the Treat-
Phthisis.—Monthly Journal, March, 1850, p. 236, *et seq.*

is not objectionable here, inasmuch as there is less risk of over-stimulation being thereby induced. Discussion having failed, then suppuration is to be sought for rather than dreaded; and, if possible, it is made to occur within the tuberculated part, in order that full disintegration and removal of the morbid product may ensue.

But, in scrofulous patients, small abscesses not unfrequently form, unconnected with tubercular deposit. These are amenable to ordinary rules of treatment; and when they are situated in a part habitually exposed, as the face or neck, a small opening should be very early made, so as to limit suppuration, favor contraction, and avoid the deformity of a large, irregular, and depressed cicatrix.

Usually, suppuration [illegible] e deposit; the abscess is of a chronic nature even fro [illegible] pproaches the surface slowly, with a broad front, enl [illegible] lly in all directions. If still anxious to avoid an un [illegible] rly and minute opening may be made; but the resu [illegible] ily partially successful. It is better practice to delay [illegible] he skin has been thinned, and until an opportunity has [illegible] disintegration of the tubercle being at all events effi [illegible] d, if not perfected. Caustic potass is then used as th [illegible] destroying attenuated skin so far as may seem necessa [illegible] e, at the same time making a destructive thrust into tl [illegible] rt. The matter is evacuated, and the diseased texture s [illegible] omes away; granulation is in due time commenced, and the ordinary means are then adopted to favor its progress and completion. Constitutional treatment is maintained, uninterrupted; and must be long persevered with, after apparent local cure; for, in the general system is the true seat of the disorder.

It is almost unnecessary to state that chronic enlargements of lymphatic glands, by tubercular deposit, as in the neck, are not to be made the subject of severe surgical operation. Discussed they may be; or by suppuration they may be broken down and extruded; but extirpation is in truth but a bloody, reckless, and unwarrantable cruelty; injurious to patient, surgeon, and surgery.

The student may consult the following works, selected from the very widely extended literature of Scrofula. *On the General Subject*:—Cullen's Practice of Medicine; Alison's Pathology and Practice of Physic; Watson's Lectures on the Practice of Medicine; Phillips—On the Nature, Causes, and Treatment of Scrofula, Lond., 1846 (particularly excellent on the causes and symptoms); Lebert—Maladies Scrofuleuses et Tuberculeuses, Paris, 1849; Bennett (J. Hughes), paper in Monthly Journal for March, 1850. *On the Structure and Chemistry of Tubercle*:—Lebert—Physiologie Pathologique, Paris, 1845; Vogel—Pathological Anatomy, translated by Dr. Day, Lond., 1847; Glover—Treatise on Scrofula, Lond., 1846; Bennett—On Cancerous and Cancroid Growths, Part II, Edin., 1849; and in the article above-mentioned.

2. *Cancer and Cancerous Cachexy.*

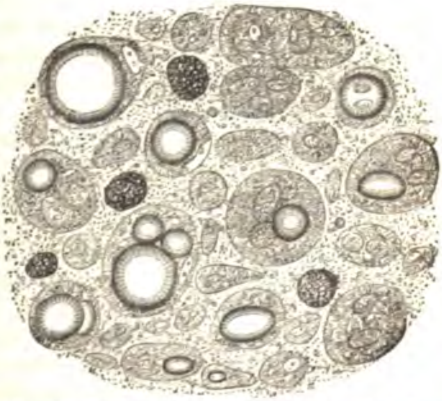
Cancer, when used as a general term, is applied to certain local growths, or tumors, known by experience, among other dangerous and fatal characteristics, to be frequently accompanied by a tendency to the development of similar morbid growths in a great variety of tissues and organs. Partly from this known tendency, and partly from the very peculiar and destructive character of the local lesions, which seem to

ower of converting all the tissues around them into diseased
s similar to themselves, the growths to which this name is given
ned for themselves in a special manner the name of *Malignant*,—
s formerly bestowed, somewhat vaguely, on all lesions resulting
and irresistible destruction of parts. The same circumstances
en rise to the doctrine, universally received by surgeons, that
rieties of morbid growth are connected, in some inscrutable way,
onstitutional affection; which is to be regarded as either the
the primary local lesion, or its immediate and inevitable result.
e that the first beginnings of this constitutional disorder are of
obscure kind; that its nature, causes, signs, and relation to the
ection, have been the subject of endless controversy; that the
n of the cancerous or non-cancerous properties of many growths
ates the seats of medical learning; yet, amid all these elements
rity and confusion, it is impossible to overlook the important
l fact, that while some tumors are limited in their reproductive
and circumscribed in their mode of growth, there are others
xtension no organ or tissue can effectually resist; and which,
ey destroy all around them, are surely followed, in course of
the invasion and destruction of distant textures, and by de-
nt of the formidable symptoms of a wide-spread and fatal

The condition of the system, implied in these phenomena, is
considered to be a cachectic affection; and although the first
s of the local disease often precede the apparent constitutional
ment, it is extremely probable that the latter may exist in a
rm prior to the former, and may be the cause of its peculiar
ies.

indeed impossible to state any signs by which the cancerous
s, or constitution, may be recognized, before invasion of the
sease. Repeated failures, however, in attempts to eradicate this
nife, even where the ex-
manifestations of it are
asily reached, have in
ars tended very much to
the idea of a vitiation of
stitution presiding over
liest development. The
rities of the anatomical
nsible characters of the
, and its differences from
normal structures of the
s well as from the adven-
structures of ordinary or
ubercular disease, seem
point to some constitu-
condition as its cause.
ture of that condition is
unknown; but its local
neral manifestations will be discussed hereafter, in the section on
rs.

Fig. 5.



Simple and compound cancer cells from cancerous duodenum.—*Bennett.*

The distinction between the scrofulous and cancerous cachexies lies, chiefly, in the peculiarities of the local derangements. But it is also to be observed that, in scrofula, the changes in the lymphatic glands have usually much less relation to the other local affections than in cancer; in which latter, the glands leading to the part primarily affected are invariably the first to become enlarged. Moreover, in scrofula, the assimilating organs are usually early involved, and emaciation is the result. In cancer, on the other hand, emaciation is by no means a constant symptom—at least till the most advanced stage; while a certain sallowness and peculiarity of complexion, supposed by some to be quite characteristic of malignant disease, is apt to attend the development of the cachexy, even before th [illegible] ons have materially suffered. Low forms of febrile act [illegible] ly of the hectic type, are common to both affections: [illegible] functional derangement, with all the varied forms of [illegible] ation, is found in both; especially in the advanced s [illegible]

Cancerous growths, [illegible] and some inflammatory products, are characterize [illegible] ndance of nuclei and cells. Without anticipating the [illegible] ir anatomical elements, which will be found in a future [illegible], we may here state that the cell structures in cancer [illegible] much more highly developed kind than those found eit [illegible] tures, or in other adventitious products. The preceding [illegible] considered as a representation of these structures in their most characteristic forms.

The literature of cancer will be found very ably digested in Dr. Walshe's Treatise on that disease. The most laborious recent researches on the subject—especially in regard to the minute structural anatomy—are those of Dr. Bennett, On Cancerous and Cancroid Growths, Edin. 1849; Lebert, Traité Pratique des Maladies Cancereuses, et des Affections Curables, Confondues avec le Cancer, Paris, 1851. See also Müller on Tumors, translated by West.

3. *Syphilis, and other Morbid Poisons.*

In syphilis, a disorder produced by impure sexual intercourse, we have an example of constitutional affection developed obviously as the result of a poison introduced into a part, and capable of being communicated from one individual to another. The phenomena attending the development and propagation of a contagious virus, are perhaps in no surgical disease so well illustrated as in this. We have first the *primary* symptoms, or those occurring in the part to which the poison is applied, and in no long time after its application; consisting of ulcers and inflammatory affections, commonly on the exposed surface of the glans penis, in the male—or on the labia, vagina, and os uteri, in the female. Next, we usually have affections of the lymphatic system in the neighborhood of the part; enlargement and inflammatory swelling of the inguinal glands, or *bubo*. And, after the lapse of a certain time, we may have the constitutional affection, displayed in the form of eruptions on the skin, ulcers of the throat and larynx, and affections of the bones and periosteum; constituting the different varieties of what is known as *secondary* and *tertiary syphilis*. They may be attended by more or less of fever; which, however, is always accidental, not unfrequentl

for long periods, and cannot be regarded as characteristic of the
n.

nature and treatment of syphilis will receive consideration here-

constitutional effects of poisons are as various as the modes of
troduction into the system. Those possessing any interest for
geon will be noticed in future parts of this work. In the mean-
may be said that in some (as will be seen in the case of poisoned
) the symptoms are those of acute febrile disease; in others (as
nous affections, with great emaciation, produced by ergot of rye)
ve more of the cachectic character; and some disorders referable
ns (hydrophobia, lead and mercurial palsy, &c.) would more pro-
e included under the class of nervous affections.

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place it may be sufficient to refer the student to the works of Travers and Car-
on the Venereal Disease; to the Treatises of Bacot and Acton—the latter with
841; to Ricord, Traité des Maladies Veneriennes, Paris, 1839; and Lettres sur le
Paris, 1852; and to Lectures by Mr. Lane, in the Lancet for 1841-42.

4. *Rheumatism.*

ne disease called *Acute* rheumatism, we have one or more joints
limbs affected with pain, stiffness, and swelling; frequently, also,
l the other symptoms of acute inflammatory action. This, how-
peculiar in character. It commonly affects a number of joints
—generally the larger ones, as the knee, shoulder, and hip; but
lso, in confirmed cases, the joints of the wrists and fingers—less
ntly, those of the toes. Although characterized, too, by extremely
uffering, it does not commonly pass on to the rapid disorganiza-
y abscess or ulceration, which so much derangement would be
o produce under ordinary circumstances. On the contrary, it
comparatively slow and lingering progress; three, four, or six
being almost the shortest time of cure. And, besides, it is very
degenerate into chronic states, in which, without any manifest
g, the pain and stiffness continue; and slow disorganizations and
ities, not only of the joints but of the ends of the bones, are the
This constitutes the extremely frequent affection—*Chronic*
ar rheumatism.

ng with such symptoms, we have those indicating constitutional
r; which, however, are mostly secondary. There is often
ely acute fever at the beginning, and in the exacerbations; while,
other hand, all the chronic changes are affected almost in the
e of any perceptible fever. There is frequently a foul tongue, an
ste in the mouth, and a highly loaded state of the urine, in which
of ammonia is thrown down as a sediment in great abundance.
cretions of the skin are also said to be unusually acid. If blood
wn in the acute stage, it presents an amount of fibrin almost
ar to this disease, and concretes itself into an exaggerated form of
coat—hereafter to be described as common in inflammatory

of the disease, these constitutional symptoms are
nt only in a very slight degree. Still,

the general diffusion of the local affections, and their evident peculiarities as compared with ordinary inflammations, indicate in rheumatism a distinct constitutional tendency; probably entitled to rank intermediate between the cachectic and febrile disorders, and requiring its own modifications of treatment.

A very dangerous peculiarity of rheumatic affections, is one only of late properly appreciated; namely, their tendency to be accompanied, in a very large proportion of cases, by diseases of the heart; either endocardial or pericardial. Such diseases, although not often fatal in the early stage, are dangerous in their ultimate tendency; and demand, therefore, great attention in the management of rheumatism.

The remedies emplo[illegible]nic rheumatism are exceedingly numerous. The [illegible] treatment must be pursued in acute cases. But m[illegible]r the effects of too great bleedings in this disea[illegible] the cardiac affection; and, especially if any signs [illegible]alomel and opium, used so as to produce moderate [illegible] for some time. In addition to these remedies, or i[illegible]nite, nitrate of potass and other salines in large d[illegible]n juice, opium alone or in the form of Dover's p[illegible], have been strongly recommended; as possessing more [illegible]gainst the specific constitutional tendency. While, i[illegible]form, frequent warm baths, Dover's powder, colchicum, [illegible]ide of potassium, and sarsaparilla, are deemed useful; singly, or combined. The proper selection from among such remedies generally requires, in each individual case, much tact and experience.

In all cases, the rhythm and sounds of the heart should be anxiously and frequently investigated; with a view to discovering the earliest signs of disease there. In the acute forms, indeed, such an investigation should be made from day to day; as a few hours may produce changes of the utmost importance. And this is one of the instances in which the surgeon who is ignorant of, or forgets, the connection between his art and that of medicine, may fall into lamentable errors; by keeping his attention too exclusively fixed on the symptoms of external disease, which are often, in this affection, its least dangerous part.

5. *Gout.*

This is another general disorder indicated by affections of the joints, and also by a wide range of constitutional disturbances; chiefly falling under the eye of the physician, to whom, much oftener than to the surgeon, the care of the gouty constitution is confided. Some acquaintance with this, however, is necessary to the latter; not only on account of the articular affections, but also because of the frequent connection of the disease, in its later stages, with calculous disorders of the kidneys and bladder.

Gout scarcely ever appears, in a marked form, in the earliest periods of life. In the majority of cases, it makes its first decided invasion in those who have passed the fortieth year; although it is not positively limited to this or any other period. It occurs, for the most part, in the higher classes of society; or in those of the lower ranks who are too abundantly supplied with stimulating diet, and have comparatively little exercise or bodily exertion. In the laboring class, it is almost unknown; and even among the manufacturing population it is very rare; while it finds ready victims in the rich man, and in the attendants who minister to his worldly display—equally exempt from the necessity of actual labor, and often equally neglectful of that moderation and temperance in living which are absolutely necessary for the preservation of health.[1] The statesman, too, and the literary man—with all others who, in affluent or easy circumstances, have to perform much labor of the brain, or endure much anxiety—are, unless early inured to habits of much temperance, not unlikely to become the subjects of gouty disorder. The disease is, moreover, more distinctly influenced by hereditary predisposition than perhaps any other malady; and is not unfrequently known to exist in a family for numerous successive generations; sometimes, it is said, missing one generation, but only to fall upon the second with unabated violence. It is besides peculiarly a disease of the male sex; females being attacked in very small proportion—probably in consequence of their generally more abstemious mode of living. In the hospitals of this country, with the exception of some in London, it is almost unknown.

Gout may be either *regular* or *irregular;* the former term being applied to its most ordinary mode of accession, in the joints of an extremity; the latter to various other affections which may take the place of the regular paroxysm—subject, however, to the constitutional cachexy, and followed, not unfrequently, by the regular disease. Into these it is not necessary to enter here. Suffice it to say, that numerous forms of neuralgia, or nervous pain, in many parts of the body, dyspepsia of various kinds, biliary derangements, oppressions of the central organs of circulation and respiration, have been described as preceding, or at different times following, the gouty paroxysm as developed in its regular form. This latter usually makes its attack in the spring of the year; ushered in by more or less gastric derangement. It most commonly seizes upon the great toe of one or other foot; but may, in particular cases, affect other joints, as those of the hand, elbow, wrist, or knee; almost always, however, selecting the smaller joints as the point of invasion. The paroxysm is attended with great pain, and, in the majority of cases, with distinctly inflammatory swelling and redness; but these last symptoms are not invariably present, at least in the earlier attacks. The pain usually comes on in the middle of the night; often towards morning. Next day, there may be swelling and redness; but as these extend, the pain is usually relieved, and, with it, the dyspeptic symptoms which heralded the attack. The paroxysm and its effects commonly last at least several days, before the part resumes its natural condition; and it is frequently observed, that afterwards the general health is better than it had been for some time previously. Recurrence of the paroxysm, however, after a longer or shorter interval, is almost certain; unless stringent precautionary measures be adopted. Or the disease may pass into some of its irregular or atonic forms, in which the internal organs are the subject of attack; and serious consequences may result.

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[1] I was once gravely consulted, by an old coachman in a somewhat too liberal establishment, as to whether "butcher meat five times a-day were wholesome." Of late, he said, he had thought it "rather heating."

The gouty constitution is marked by various signs; none of which, however, are so constant as to be entirely trustworthy in any particular case. The constitutional character of the affection is presumed—first from its tendency to recur and to assume many different forms; secondly, from its connection with hereditary predisposition, improper regimen, and other constitutional causes; thirdly, from the coexistence of various habitual alterations of secretion—which may be considered as, in most instances, the indications of an improper assimilation. One of the most frequent a is the tendency to an undue generation of uric acid d, as has lately been shown by Garrod, in the bloo robable that this substance is produced at the ex which form the greater part of the effete nitrogeni ly are, in the normal state, thrown out of the syste sidered the uric acid to be a true blood-poison; and, or *materies morbi*, of gout. But this has never been actorily; while many pathological facts render it more this vitiated secretion is a consequence, rather than a ase.

The increased formation gout, is important to the surgeon in two points of view. In t place, it forms in conjunction with soda (urate of soda) a great proportion of certain concretions, which under the name of chalkstones have long been known to attend the ultimate disorganization of gouty joints. Secondly, it constitutes one form of gravel, or urinary calculus; an affection to which the gouty are specially subject, and which leads to most distressing symptoms, frequently requiring surgical interference.

Management of the gouty constitution depends essentially upon a proper regimen being strictly maintained. But it too often happens, that the subjects of this disease are affected with a voluptuous inactivity of mind, which frustrates all the efforts and advice of the most judicious practitioner. In the early stages of the affection, however, its recurrence may almost invariably be prevented, or delayed for a considerable time, if the patient can be induced to adopt a moderate system of diet, with regular habits of exercise. And this must be insisted on by the practitioner, as a part of the treatment paramount to all others. In the management of the paroxysm, a vast variety of measures have been recommended; but the enumeration of these belongs rather to a medical than to a surgical treatise. The treatment of the arthritic and calculous disorders will be discussed hereafter.

Out of the ample range of literature connected with Rheumatism and Gout, the student may consult Cullen's Practice of Physic; Graves' Lectures on Clinical Medicine; Scudamore on Gout, Lond., 1817; Prout on Diseases of the Urinary Organs, Lond., 1849; Todd on Gout and Rheumatism, Lond., 1843; Macleod on Rheumatism, Lond., 1842; Chomel—Clinique Medicale, Paris, 1837–40; Bouillaud du Rhumatisme Articulaire, Paris, 1840 (especially in connection with diseases of the heart); Latham on Diseases of the Heart, Lond., 1845; Gairdner on Gout, Lond., 1851. Perusal of Sydenham's personal experience of Gout will also well repay the reader's labor.

6. *Scurvy, and other Hemorrhagic Affections.*

There are several constitutional disorders in which the blood appears to be so altered in quality, or the vessels so much weakened, that extravasation readily takes place in various parts of the body. In so far as these bear upon the subject of external hemorrhages, they will be discussed afterwards, under the title of the *Hemorrhagic Diathesis;* a condition which not unfrequently interferes most seriously with the surgeon's curative efforts, besides forming a spontaneous source of danger. One of the most common indications of such affections is extravasation of blood into the tissue of the skin, in the form of purple spots (*petechiæ*) seen beneath the epidermis, and sometimes in larger patches or strips of a similar color (*vibices*). These blotches constitute the disease called *Purpura*, which is sometimes simple and manageable, but not unfrequently accompanied by a tendency to bleeding from the mucous membranes, especially those of the nose, bronchi, and intestines; or with a low type of fever, terminating either in fatal hemorrhage, or in typhoid symptoms. The nature of these affections is very obscure.

Scurvy is one of the hemorrhagic class of diseases, which has attracted much notice by its epidemic occurrence; and presents some very peculiar features. Until within the last few years, it was considered by most medical men in this country to have almost disappeared, at least in its more aggravated and epidemic forms, from the catalogue of modern diseases; under the influence of increased civilization and medical knowledge. But its late recurrence in various countries in Europe and America, and to a marked extent in our own hospitals, has shown that it is not confined to any period of human history; and that its original and general character as a maritime disease, from which its name of *sea-scurvy* is derived, is much too limited.

Scurvy is characterized by a spongy state of the gums, which become livid and sore, ulcerating and sometimes sloughing, bleeding on the slightest touch, and by their relaxation causing looseness of the teeth; also by blotches and swellings in the subcutaneous areolar tissue, particularly in the hams and calves of the legs; the swelling often hard and firm, and presenting much the appearance and color of the ecchymoses proceeding from a blow. With these enlargements there is commonly the appearance of petechiæ over various parts of the skin; and occasionally, though not so frequently as in many other hemorrhagic diseases, there are bleedings from the mucous membranes. These symptoms are accompanied by various flying, or persistent pains in the bones, muscles, and periosteum; by great despondency of spirits, and often by an anemic and sallow appearance of the skin generally. There is not unfrequently fever, in some stages of the affection; but this is quite as often absent, and then the tongue is clean, the pulse is natural, and the appetite may be unaffected till a late period.

This disease is apt to be confounded with rheumatism, on account of the pains in the joints and muscles; and the ecchymoses are not unfrequently mistaken for bruises, to which indeed they often bear a tolerably close resemblance. Their existence at various points, and without adequate cause; their coexistence with petechiæ, and with a spongy condition of the gums; and, particularly, inquiry into the history of the patient and his dietetic circumstances—will always enable the careful practitioner to distinguish scurvy from all other surgical affections. The presence of an epidemic of scurvy, at the time, will of course prepare him for the diagnosis; and will also guide him to the cause of the disease and to its treatment, better than will the investigation of individual instances.

Scurvy always depends on dietetic errors or deficiencies. Various other circumstances appear to favor its development; as the operation of cold, depressing mental emotions, great exhaustion, the action of mercury, &c. But although abundance of predisposing causes can generally be traced—[illegible] dreadful epidemics of this disease, with which [illegible] erly so frequently visited—there is no proof that [illegible] rred independently of great deficiency in quantit[illegible] f the food. And the late epidemic, in this and [illegible] bears out that view; occurring during a period of [illegible] when one habitual article of food, the potato, was [illegible] large population which had been more or less depe[illegible]

In many instances, there [illegible] ed diminution, or total want in the supply of fresh v[illegible] d the normal state of health is restored on the addit[illegible] dietary. Other cases, however, are with difficulty explained on this theory; and in the remarkable epidemic observed by Dr. Christison in Perth Prison, the simple addition of milk to the diet of the prisoners seemed to act perfectly in restoring them to health. In general, it may be said that the scorbutic patient should be placed on a liberal diet, embracing all the usual elements of the food of a healthy individual, in good quantity and quality. Care should be taken, in particular, to include fresh succulent vegetables as part of this diet, with a sufficiency of nitrogenized elements, such as milk, flesh, &c. In addition to these precautions, the cure is usually much facilitated by the administration of acid vegetable juices, such as lemon or orange juice, in the quantity of three or four ounces a day. In smaller quantities, the lemon-juice may be used with the best effect as a preventive, under circumstances where scurvy is likely to make its appearance. This prophylactic, which has been systematically employed in the British Navy since 1795, has had the effect of almost completely extinguishing one of the most virulent and devastating disorders to which our seamen were subject. The allowance to each man is one ounce daily.

Of the older works on Scurvy, the most noted are, Lind on the Scurvy, Edin., 1753; Blane on the Diseases of Seamen, Lond., 1785; Trotter—Observations on the Scurvy, and Additional Observations, Lond., 1792 and 1795; Larrey, Expedition on Egypte, Paris, 1803. In later years, Fodéré—(Dict. des Sciences Méd., Art. Scorbut), 1820; Latham on the Diseases of the General Penitentiary, Lond., 1825; Budd—(Library of Medicine, Vol. V, Art. Scurvy), 1840. The epidemic of 1846–7, produced various memoirs in this and other countries, of which the following are the most important:—Christison, Ritchie, Lonsdale, Anderson, Garrod, in Monthly Journal, June—August, 1847, and January, 1848; Fauvel—Archives Generales, Vol. XIV, p. 261; Foltz—American Journal of Medicine, January, 1848; Shapter, Med. Gazette, 1847, p. 38; Curran—Dublin Med. Journal, New Series, 1847, p. 83. See also British and Foreign Medico-Chirurgical Review, October, 1848, p. 439.

Several other cachectic disorders might be mentioned, as bearing in a greater or less degree on surgical practice; but the preceding are the most important. Leprosy, Sibbens, Frambœsia, Yaws, and the Italian Pellagra, are affections more curious than practically interesting to the practitioner, in this country and age. Other portions of this subject have such special relation to certain local diseases, that they are best treated of in connection with particular departments of surgery.

AFFECTIONS OF THE NERVOUS SYSTEM.

The diseases which affect peculiarly the nervous system are here ranged as a separate class; not, as has been already stated, because other parts of the economy may not be engaged in their production; but simply because the symptoms they display are chiefly such, as undoubtedly spring from perverted nervous function. Before discussing the more complex forms of these affections, as they ordinarily occur in practice, it will be advisable, in the first place, to isolate the simplest elements of perverted nervous function, and place them before the student in connection with the physiology of the nervous system. It will be remembered that the nervous centres have many distinct functions. Thus, the hemispheres of the brain are the organs of the intellectual faculties, and in great part of consciousness, sensation, and voluntary motion; while the central parts of the encephalon are connected with the instinctive and automatic acts, and serve also as conductors between the hemispheres and the nerves. The cerebellum, according to the experiments of Flourens, is also connected with the manifestation of motor power; being the organ of the co-ordination, or regulation, of movement. And the medulla oblongata and spinal cord have been shown, especially by the labors of Dr. Marshall Hall, to be the seat of a great and important function; that of reflex or excito-motory action, by which, independently altogether of the cerebral function, impressions on the sensory nerves of the skin, or other parts, are carried to the spinal cord, and reflected along the motor nerves so as to give rise to certain definite and often regulated movements. It is important to keep these great distinctions of function in view, while considering the pathological conditions to which the nervous system is subject; although we may not always be able to separate them completely from one another, in our idea of any one disease.

The action of certain poisons affords the best means of realizing in our minds the idea of perverted nervous function in its simplest forms; and the same substances, in virtue of the same properties, become our most valued remedies in nervous diseases. Thus, in opium we have a substance which affects chiefly, and in the first place, the cerebral functions, especially those of the intellect; producing first drowsiness, then complete stupor; and afterwards involving in its effects the centres of reflex and instinctive action, and thus producing death by suspension of the respiratory acts. In hemlock, on the other hand, we have a poison of precisely an opposite character; exerting its action primarily on the spinal cord, and hence producing paralysis and loss of sensation in the extremities, and at a later period death, with only a very partial affection of the intellect. Strychnia acts by increasing the spinal excito-motory power of ıe cord, which is depressed under the action of hemlock; and hence a tendency to uncontrollable and exhausting spasm, or tetanic convulsions; death ensuing either from exhaustion or from obstructed respiration. Many of those remedies, again, which ultimately exhaust and destroy the intellectual power, appear in the first instance to produce excitement of function. Even opium seems to do this, in some constitutions; and the whole class of alcoholic and ethereal compounds produce violent excitement of the brain, delirium, and ultimately a secondary suspension of function. The same substances appear also to act on the cerebellum; giving rise to the tottering gait, and ill-regulated motion, characteristic of drunkenness. Finally, some remedial or poisonous agents seem to act in a special manner on the terminal extremities of the nerves; abolishing sensation there, even in a greater measure than they affe Such a substance is aconite; which produces numb nsation throughout the extremities, as one of it fects. Probably chloroform too, and ether, act sim although these affect also the intellectual facultie measure.

The study of nervou s many inquiries, important in both a scientific and ew; bearing upon the right administration of reme the recognition and distinction of nervous diseases. n l discussion of this subject within a limited space, however y to employ some selection; and the most simple and c a of perverted nervous function appear to be those l de the student. We shall consider therefore in succession—1st. Perv rted Intellectual Function; 2d. Perverted Sensation; 3d. Perverted Motion.

1. *Disorder of the Mental Functions.*

This may assume the form either of excitement (perverted action) or of diminished power. It is probable that in disease we never have absolutely increased mental activity; although we may have increase in the relative prominence of one or other of the functions. In sleep, the strictly intellectual faculties are set temporarily at rest, and withdrawn from the control which they habitually exercise in waking hours over the fancy, affections, and all the lower acts of the mind. Accordingly, we have these presenting themselves in dreams, under abnormal and apparently exaggerated conditions; although there is no reason to believe that they are positively exalted; on the contrary, we know that in deep sleep they are suspended, like the others.[1]

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[1] A curious phase of mind lately occurred, during the fatal illness of a most eminent literary character. Awake, with his eyes half-shut, and the light of day let tolerably freely into the room, a printed page appeared before him, from which he might read for hours consecutively. Sometimes it was in the form of a leading article from the Times, Spectator, Daily News, Examiner, or Economist—papers he was in the habit of seeing; sometimes it was an article from the Edinburgh Review; sometimes, and more frequently, from the Quarterly. On one occasion, it was the history of the Maccabees, in the Apocrypha. The original writings he described as novel, able, and presenting striking views of things. Ever and anon, he would shut his eyes, cease reading, and think of what he had read; sometimes agreeing with the statements and opinions, sometimes finding reason to dissent from them, and not unfrequently detecting subtle sophisms with much intellectual satisfaction. Opening his eyes wide, and letting daylight fully in, the book became translucent, he saw

Something similar to this not unfrequently takes place in disease. We may have the intellectual functions abolished; or, being active, greatly perverted. If the imagination remain at work, the phenomena of *Delirium* occur; the mind presenting fallacious or insane images, which generally follow one another in rapid succession, and are apparently quite uncontrolled by any reasoning process. Delirium may exhibit many forms; it may be either active and furious (*mania—delirium ferox*), indicative of a strong will, unrestrained desire, and intact sensibility to impressions, with the powers of the body unimpaired. Or it may be low and idiotic (*typhomania*), often accompanied with great diminution of bodily powers, and with few mental phenomena of any kind; the man being reduced, as it were, to a machine, doing almost nothing spontaneously, and showing only by inarticulate words, and a few irrational movements, the characteristic perversion and prostration of the cerebral functions. Or particular affections and acts of the mind may assume an undue prominence, the action of the whole being disturbed. Then, fixed ideas, often of a religious kind, or proceeding from highly wrought feeling or fancy, or merely sensual emotions, may take possession of the mind; as is seen in various kinds of both transient and permanent insanity. All these forms are liable to occur in connection with different febrile affections, as we have already in part seen.

Again, the existence of fixed ideas, unrestrained by reason, which in other respects holds its usual sway, may be the only evidence of perverted mental function. This is found in various forms of partial insanity, and is usually to be referred to an over-mastering impression of some kind, either bodily or mental. Examples of this perverted cerebral function, without delirium, occur in connection with particular diseases, especially if of a painful kind; and most frequently, perhaps, in the form of perverted sexual appetite.

Simple abolition or great diminution of mental activity, without any special derangement, constitutes idiocy or imbecility; a state which seldom requires any surgical treatment.

The condition of *Coma*, in which a gradual suspension takes place of the whole cerebral functions, beginning with the intellectual and moral, afterwards involving the instinctive and automatic acts, and finally the unconscious reflex phenomena, is one of frequent surgical occurrence; both in typhoid fever, and in connection with injuries of the brain or head. In its first stages, there may be delirium, though very commonly this is absent; soon there is perceptible lesion of voluntary motion, and also of sensation; the patient is torpid, passive, in a condition allied to very deep sleep. In this state the pupil is commonly dilated, and more insensible to light than in the natural condition; and, according as the great reflex centres of motion and sensation become involved, the respi-

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through it, and could read no longer. Half-closing his eyelids, and partially darkening the room, the page and print were again distinct, and he read on as before. The mind constructed and composed the printed pages; then read it as something new and interesting; and debated, within itself, on the merits and truthfulness of the statements. This lasted for two or three days, during waking hours; the page sometimes coming spontaneously, sometimes assisted by volition. There was no delirium; and the patient was much amused and interested in the phenomenon. After death, considerable gelatinous effusion was found beneath the arachnoid; in other respects, the brain was healthy.

ration is slow and labored—accompanied, especially if the patient lie on his back, with an exaggerated form of the snoring of natural sleep. This condition is always one of the most dangerous kind; being the beginning of a general suspension of nervous function. Unless the cause can be removed, it is sure to pass to a fatal termination; the respiration becoming slower and slower, while the pulse, which up to this period has been strong, full, and (in the absence of fever) slow, becomes weak, and possibly rapid and intermitting; stupor deepens; the evidences of sensation cannot be brought about, even by the strongest stimuli; and in a short time the whole of the bodily functions are abolished, on the suspension of respiration and circulation.

The treatment of ction is much modified by
circumstances; and ca practical experience of the
particular diseases in the application of remedies
to nervous disorders, h come in themselves a source
of danger and discomfc view the particular action of
those remedies, to some has been already directed.
Those which act by gi igher faculties of the mind,
with the least possible the nervous functions or of
the circulation, will be most eful; and, in this point of
view, opium and hyoscyam former, rank first in our list
of *narcotic* remedies. Bu observe that all these remedies may become dangerous, if any tendency to coma is manifested; a caution which has already been shown to be most important in typhoid fevers; but which will be found not less applicable to many other forms of delirium—as those from injury, or from inflammation within the brain.

2. *Disorder of Sensation.*

Pain is a heightened and perverted condition of the sensory functions; arising either from undue application of a local stimulus to the nerves, or from an abnormal condition of the conducting or receiving organs. Hence it is important to distinguish several kinds of pain.

It may proceed from local irritation; applied either at the part itself where it is felt, or at some other part—generally connected with it in function, or by receiving nerves from a similar anatomical source. When pain is produced by a distant irritation, it is generally called *sympathetic;* and instances of this will frequently occur in other parts of this work. One source of such pain, it is to be remembered, is in the law of nervous action—that an irritation, applied in the trunk of a sensory nerve, is always felt at its extremity. Thus, the stump of a limb still feels for a long time the presence of the amputated member; and irritations applied during operations in the neighborhood of the greater nerves of the extremities, are invariably referred to the skin or the fingers or toes, as the case may be. But another source of sympathetic pain is to be found, in the associated actions of different nerves; which seem to be connected with each other at their spinal or cerebral centres, or among plexuses and ganglia in their course. And some instances of undoubted sympathetic irritation occur, which are difficult of explanation on either of these theories.

But pain may be produced otherwise than by local irritation. It may occur in consequence of heightened sensibility of the central organs; and this sort of pain has been called *subjective*. It is remarkable that the centres of the nervous system, being the special seats of sensation, are themselves insensible to irritations locally applied. Subjective sensations are to be judged of by the absence of any supposable local cause of irritation; and also by other evidences of diseased nervous function in the central organs; or, if these are not present, by the failure and inefficacy of local remedies. A careful diagnosis as to the origin of pain may be of the utmost importance; but it is often difficult. And what increases its difficulty is, that a local cause is not unfrequently combined, as in some neuralgic affections, with heightened susceptibility of the central organs. In such cases, a careful watching of the effects of remedies, experimentally tried, becomes often our only means of diagnosis.

It is very certain that pain may in itself become a dangerous symptom; especially if combined with the mental excitement, and secondary prostration, which often accompany it. The agony and painful shock of operations have often been known to prove fatal; even when the operation has been in itself trivial.[1] In disease again, pain, however distressing and exhausting, is not usually an *immediate* source of peril to the sufferer; although, unquestionably, a constitution may be readily undermined by the mere sleeplessness and exhaustion attendant on a painful malady.

Against the immediate dangers of pain, however caused, we have now a resource unknown to our forefathers, in the discovery of *Anæsthetic* agents—such as ether and chloroform; which, with the most transient effects on the general system, have a property of removing all local sensibility. For details connected with the management and application of these, we refer to the subsequent part of this work, and to the monographs of Dr. Simpson and others on the subject.

In the more persistent varieties of pain arising from disease, and where the local cause cannot be removed, the sufferings of the patient may often be mitigated by local applications of a soothing or anodyne kind. Thus, cold applied, in the form of pounded ice, for a considerable period, is known to act as an admirable local anæsthetic; when it can be borne by the constitution. And moderate heat, somewhat greater than that of the internal parts of the body, especially when applied in the form of vapor or moisture, has also a benumbing and grateful effect upon irritated nerves. Almost all the narcotic remedies have more or less of this power; especially aconite, opium, prussic acid, belladonna, and the vapor of chloroform; and all of these may be safely tried in local affections.

But, not unfrequently, a general remedy is required; either to combat a general cause, or to secure a more successful victory over the painful effects of a local irritation. The different remedies which act on the nerves are here indicated; and aconite, chloroform, belladonna, hyoscyamus, or opium, may be employed according to circumstances. The first of these acts almost purely on the nerves of sensation, and is therefore often to be preferred; but its sedative action on the heart may render it a dangerous remedy in considerable doses, or when its use is long protracted. With regard to all the others, it may be said that while we can usually obtain the effects we desire, there are other results inseparable from these, which render the prolonged and habitual administration of such drugs a very hazardous and doubtfully advantageous practice. The general use of narcotics against pain, therefore, ought in great part to be confined, in surgery, to those cases where the pain arises from a temporary cause; and where these remedies can consequently be used, without the dangers which arise from their becoming a part of the patient's habitual regimen. They are undoubtedly among the most powerful agents in the hands of the surgeon; but, like all such remedies, require the utmost discrimination and care in their application.

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[1] See Travers on Constitutional Irritation, Vol. I, chapter i, sect. 2, for many interesting examples of morbid irritability, in some cases fatal.

It should never be forgotten, that although pain is the most common expression of diseased se [illegible] ted nervous function of this kind may occur without [illegible] the cerebral functions are obscured, or when any p [illegible] ting faculty of the nerves is injured. In these cases, [illegible] of the injury to the nervous function by knowing its [illegible] g those effects which will be presently treated of, un [illegible] ation.

Anæsthesia—lost or di [illegible] either of a part, or of the whole body, is a conditi [illegible] ts opposite to that of pain. Like the latter, it may ac [illegible] either of the central organs of the nervous system, or of the [illegible] pparatus. Thus anæsthesia is found resulting from suspe [illegible] rebral functions in coma, in which case it is general; or [illegible] ections of the central parts of the brain, in connection with loss of motion—being, in this case, commonly limited to one side of the body; or from disorders of the spinal cord; or from the effects of disease, pressure, &c., upon the nerves themselves, in some parts of their course; or, finally, from certain local anæsthetic agents, such as cold, which have the power of acting upon the sentient extremities of the nerves, sometimes with, and sometimes without, a corresponding effect upon the motor functions. Examples of all these kinds of anæsthesia, either simple or combined, are found in the action of the different narcotic poisons, and in many diseases which fall under the notice of the physician.

Anæsthesia is never a subject for surgical treatment, unless its cause be external and capable of removal; in which case, the affection is always either general, from cerebral disorder of a surgical kind; or partial, from disease or injury of the spinal cord, or from tumors, &c. pressing on the nerves. A knowledge of the physiology and pathology of the nervous system is the only sure guide to recognition of the cause, when this is obscure; and its capability of removal must be judged of upon the ordinary principles of surgery.

3. *Disorder of Motion.*

The motions which are observed in animals have been always distinguished as voluntary and involuntary. The former class comprise those under the direct influence of the will, and connected therefore, physiologically, with the mental manifestations, and with the external parts—more especially the gray matter—of the cerebral hemispheres. The latter includes various kinds. Some appear to be truly instinctive, or automatic, in character, and are probably evolved particularly in the central ganglia of the brain, and in the medulla oblongata; presenting also considerable co-ordination, and often brought under the influence of voluntary impressions, although not necessarily dependent on them. To this kind belong, as the physiological student will at once recollect, the actions of respiration, and numerous other phenomena occupying a middle place between the true voluntary motions and the purely involuntary. Another series of involuntary motor acts is the reflex; which are the result of stimuli applied to the sensory nerves, and reflected through the spinal cord, without necessarily producing either sensation or volition. These acts are generally less complicated than the instinctive; possessing less co-ordination, and being more immediately the result of external circumstances. Over these, however, the will is capable also of exercising some degree of secondary control; either diminishing, or increasing their energy. Finally, there are the purely involuntary acts; educed partly under the influence of true reflex action through the cord, and partly, in all probability, through the ganglionic system of nerves; while some of them seem to have their origin in stimuli applied directly to the contractile parts. Of this kind are the actions of the gullet and alimentary canal, and of the heart; which, like most of the organic motions, are totally withdrawn from the influence of voluntary power.

It appears, therefore, that the nervous system is concerned in the production of motion in four different ways; first, as the originator of voluntary acts, in which the gray matter of the cerebral hemispheres is chiefly involved; secondly, as the originator and co-ordinator of instinctive motions, a function which belongs to the central parts of the cerebral matter; thirdly, as the source and regulator of reflex actions, which are dependent upon the integrity of the spinal cord and medulla oblongata; and fourthly, as the conductor of all the isolated and co-ordinated impressions, whether originated by external stimuli or not. The conducting fibres of the nervous system are found accordingly in all its parts; and form communications between the circumference of the encephalon and its central ganglia, between these latter and the spinal cord, and, through the nerves of sensation and motion, between the nervous centres and all parts of the system. Disease of the motor function, therefore, may arise from lesions of any of these parts.

The motor function may be exalted in disorders of the intellectual faculties, through either excess or irregular action of the voluntary motor power. This is often witnessed in the condition of delirium; the phenomena of which have been already so fully adverted to, both in this section and in a preceding one of the present chapter. On the other hand, the voluntary motor power is suspended, or diminished, in coma, lethargy, sleep, and in some forms of insanity. In these cases, the automatic and other motions may remain quite active, while the voluntarily are entirely at rest.

Disordered motion, in the voluntary muscles, may also occur from either excessive or defective automatic or reflex power. In the case of excessive action, the irregular motions have commonly what is called the *Convulsive* character; that is, they are co-ordinated and regulated to a high degree, but not subject, as in the normal state, to voluntary control or excitement. Convulsions may occur when the mental functions are disordered and suspended; as in apoplexy and epilepsy, when they are accompanied by deep stupor and insensibility. Or they may be quite independent of any mental affection, and uncontrollable by the will, though probably cerebral in their origin; as in the peculiar, and generally partial, jerking convulsions, which accompany chorea, or St. Vitus' dance—habitually absent during sleep, and usually increased by the voluntary attempt to control them. Or, again, they may be spinal in character; disorders mainly of the reflex function, and either entirely or in great part removed from mental control and influence; as in those formidable convulsive di [illegible] fter particularly described, tetanus and hydrophobia [illegible] power of motion be defective, we have *Paralysis* [illegible] scles; the paralysis, under these circumstances, tal [illegible] ular groups and series of muscles, corresponding [illegible] nervous centres affected. Thus, disease of the cent [illegible], when confined to one side, usually produces paralysi [illegible] le of the body and face—a condition termed *Hemipl* [illegible] of the spinal cord produces loss of motion in that portion of [illegible] supplied by nerves arising below the affected part—th [illegible] termed *Paraplegia*. The former affection is usually m [illegible] ment; but the latter comes frequently under the surgeon's care, [illegible] nection with injuries of the spinal cord.

Finally, disorder of the motor function may be perfectly independent of disease or injury of the central nervous system; arising from irregularity in the functions of the nerves, or of the muscles themselves. Exalted motor function of this kind is commonly called *Spasm*, as opposed to the convulsive affections which spring from the nervous centres. Spasmodic action of the muscles is usually local, or almost confined to such sets of muscles as are supplied from a single nerve, or from a plexus of nerves coming under the action of a common source of irritation; and it presents none of the co-ordinated or regulated character, which we have seen to characterize convulsive diseases. It is also entirely withdrawn from voluntary control; commonly unaccompanied by any lesion of the mind; and attended by acute sensibility, often amounting to great pain in the muscles affected. The condition frequently arises apparently in the muscles themselves, from no very appreciable cause; it is then called *Cramp*. Not seldom, however, it has its origin in irritation of the nerves; and then is usually combined with corresponding alterations in sensibility. The cause of irritation may be some external agent, acting on the sensory nerves of the skin, so as to produce reflex action; or it may be internal, and then gives rise to a great variety of curious phenomena, which, in so far as they are interesting to the surgeon, will be referred to in other parts of this work. In the meantime, spasm of the glottis, which occurs from irritations of foreign bodies in the trachea, and sometimes from irritations in the gullet or alimentary canal, may be referred to as a most instructive instance of a pathological condition similar to many physiological reflex actions; and as showing the necessity for an extended study of nervous phenomena, to form an accomplished surgeon.

Opposed to spasm, is the condition of abnormal relaxation, or *Partial paralysis* of particular muscles, or sets of muscles. This most commonly arises from functional disturbance of the nerves of motion; or from the pressure of tumors, or other foreign bodies, upon the trunks of nerves. Sometimes it occurs from the effects of poisoning by lead; which has a specific power of producing partial paralysis of some voluntary muscles, especially of the extensors of the thumb and fingers. Sometimes also it shows itself as the effect of exhausted irritability in the muscles themselves; and this is apt to occur in the hollow muscles, such as the urinary bladder, from continued over distension of their fibres; a state which leads to a necessity for surgical interference in order to procure evacuation of the organ.

Irregular motor action may take place in the organic muscles, which are removed from the influence of the will; giving rise, in the intestinal canal, to many morbid conditions, such as colic, tenesmus, vomiting, antiperistaltic action, &c. Most of these, however, fall under the notice of the physician, rather than of the surgeon.

The application of remedies to diseased conditions of the nervous system which produce disordered motor functions, must be guided by an accurate knowledge of the physiological action of the remedies used. Some of these are curative by their power of suspending or diminishing the activity of one or other portion of the nervous system. In this way, the pure narcotics, such as opium, hyoscyamus, &c., act, as already mentioned, on the intellectual faculties and voluntary movements. They can rarely however be brought to affect the automatic movements, without danger of suspending respiration, and thus inducing a fatal result. Conium, on the other hand, has a more decided effect on the spinal cord, especially on its lower portions. Strychnia has the precisely opposite effect of heightening reflex action, and inducing a state similar to tetanus; and is used in paralysis when depending on functional inactivity of the cord or nerves. The administration of these, and other remedies, in surgical cases, will be discussed in detail hereafter.

4. *Irritation.*

This word is here used to denote a morbid condition, the most marked symptom of which is pain, with other functional disturbance, either local or general; but differing from inflammatory, and other organic diseased conditions, in the absence of changes in the nutritive and vascular functions, or at least in the comparatively slight and secondary character of these. This state is sometimes, no doubt, owing to preceding inflammatory or other deviations from the normal state; but, in many instances, such antecedents cannot be detected, while in others they are totally incommensurate with the results. Therefore, Irritation has been commonly recognized as a condition in which the nerves enact the principal, and sometimes probably the sole part.

The morbid state may be either local or general.

Local Irritation.—Its signs are negative as well as positive. Little or no increase of blood is to be found in the part, little or no effusion or exudation, and no change of structure; little unusual heat, and no swelling—unless indeed there be a shade of tumescence, by reason of an unwonted fulness of the areolar tissue; no redness—but sometimes a paleness of the part, from temporary anemia there; sometimes a livid hue, from temporary passive congestion. Pain is the prominent symptom—sometimes slight, usually intense, occasionally excruciating; unlike that of inflammation—which will be described in the next chapter—as great at the beginning as at the last; not only remittent, but intermittent; worse at one time than at another, and during certain periods altogether absent. The general function of the part is disordered; secretion, for instance, may be either increased or diminished in quantity, and variously altered in quality.

As an example of Irritation, we may mention disordered function and sensation in the rectum [illegible] of ascarides there; the pain not often great, and [illegible] predominant sensation of itching. Stone in [illegible] leads to various grades of perverted vascular act[illegible] first may cause only Irritation; and the pain in [illegible]vere. Tic douloureux—the agony of which is prov[illegible]ected, more or less directly, with structural change [illegible] many cases no such alteration can be detected, a[illegible] pure Irritation.

The *Cause* of Irritation i[illegible]tion of an irritating agent directly to the nerves of th[illegible] same nerves, at a distance from the part affected; o[illegible]es, intimately connected by sympathy with those involved in [illegible]minent functional disorder (p. 70). The irritating agent may be either external to the body, or of its own production; foreign matter of any kind, for example, applied from without; or structural change, the result of inflammatory action, affecting either the part itself, or a distant portion of continuous tissue. Thus, a rubbing of the surface produces irritation of the part rubbed; stone in the bladder produces irritation, both directly and indirectly—in the vesical coat with which it is in contact, and also referred to the mucous membrane of the orifice of the urethra; foreign matter lodged in the kidney acts in the same way; and ascarides of the rectum produce abnormal sensation both there and at the other extremity of the mucous canal. Disease of the hip-joint causes irritation at the knee; affection of the liver, at the shoulder; disease of the uterus, in the mamma; and structural change in the brain is suspected, not without good reason, of inducing some of the most intractable forms of neuralgia in the face. Again, an irritating agent applied to one part of the body may induce an irritation in another and distant part, with which it has no apparent connection, either by sympathy of function, or by continuity of nervous or other tissue. Foul accumulations in the *primæ viæ*, for example, may occasion irritation in the face or in the heel; such perverted sensation ceasing on effectual discharge of the noxious fæculent matter.

Although many examples of irritation are afforded by neuralgia, it is not to be supposed that the terms are strictly synonymous. Neuralgia is of two kinds: a perverted nervous function only; or this dependent on organic change in the nervous structure. It is only the former which constitutes true irritation; structural change may be the cause, the irritative agent, but is not the disease itself.

Inflammation and Irritation are in themselves plainly distinct; yet the latter may induce the former; vascular excitement, of a true sthenic type, following on the nervous disorder. In fact, under such circumstances, this irritation may be considered analogous to the nervous disorder, much more brief in duration, which precedes ordinary establishment of the inflammatory process. The period of incubation (p. 95) may be said to be peculiarly long. The change having occurred, however, the minor action—irritation—becomes merged in the greater, inflammation; the two are incompatible. Thus stone in the bladder may cause first irritation there, and then cystitis; simple toothache may be followed by gumboil; irritation at the orifice of the urethra, from lodgment of foreign matter in the kidney, may be followed by puriform discharge, simulating ordinary gonorrhœa; ascarides, after much direct irritation, may lead to abscess from inflammation of the bowel.

Treatment.—The indications of treatment are obvious and simple; 1. To remove the cause; and 2. To allay the perverted function of the nerves. Often it is sufficient to fulfil the first. Take away a stone from the bladder, ascarides from the rectum, a carious tooth from its socket, and in many cases the irritation will be found to disappear very speedily thereafter. If not, then have recourse to the direct application of sedatives and anodynes to the part; and sometimes this class of remedies may also be exhibited internally with advantage. Heat, it is well known, is powerful to subdue nervous pain. It is to the steam of hot water that many trust for allaying nervous disorder preceding vascular action, after wounds or other mechanical injuries. And heat, either dry or moist, is by the voice of every-day experience declared highly available in mitigating irritation of the bowels, as well as the simple neuralgic form of toothache. Opium, indisputably anodyne, may be used in various ways; it may be gently rubbed on in a liquid form; it may be laid on as a poultice or plaster; or the skin may be exposed by a simple vesicant, and a salt of morphia sprinkled on the raw absorbing surface. Lately it has been proposed to make direct use of the salts of morphia, by inoculation; and the practice has been followed with some success. Hydrocyanic acid may be applied in the form of lotion, or cautiously painted on the part with a hair pencil. Aconite and belladonna are of much service; in the form of either unguent or liniment. Conium, or other selections from the anodynes, may be similarly employed (p. 71).

Stimuli may be used indirectly, somewhat on the principle of counter-irritation; and sometimes they give relief. A blister on the surface may mitigate a deep-rooted irritation; artificial irritation of the gums may relieve neuralgia of the face. But they should not be applied directly to the part, otherwise they will very probably rouse vascular action in a sthenic form, inducing inflammatory disturbance.

A third indication may be stated in some cases; not the least important. To change, if we can, that perverted state of system, which we find to be so often connected with local irritation. For this purpose certain constitutional remedies are known to possess peculiar virtues; one or other of these we employ; not always, however, with a thorough knowledge of their action. The most efficient probably are, iron, arsenic, quinine, and iodide of potassium.

General or Constitutional Irritation.—In this case, perversion of function is not limited to the nerves of the part; but pervades the whole system, and does not appear to be especially connected with the function of sensation. In general irritation, it is probable that the first disorder of the nerves is sthenic excitement, sooner or later declining into an asthenic perversion of function. The entire frame suffers in consequence; and the febrile disturbance is of a low type, wholly different from the inflammatory, and corresponding with some of the lower forms of irritative fever. Strength is more or less impaired; anxiety is expressed by the countenance, a s, tone, and gesture of the patient; he is restless uces change of posture oft repeated, much more which is general; sleep is snatched, disturbed, a e is great susceptibility of external impressions— sthenic form of excitement being not yet past; th vement, or sound, suffices to startle and alarm; in g pale, cold, and contracted; occasionally a dry heat ansiently over it; the countenance is pale and shrunk— the general surface, temporarily flushed; sometimes cumscribed spot of red; the pulse is rapid, but neith sometimes giving the sharp nervous jerk, and leaving the vess n the beats, as if collapsed and empty; often small, indistinct, and fluttering; occasionally intermittent—indicating impotent tumult of the general circulation, instead of energy and tone as in excitement of the inflammatory type; the tongue is at first loaded, whitish, and moist—ultimately becoming dry, glazed, and preternaturally clean; the stomach is often, but by no means invariably, disinclined for food, and is apt to reject the little which it receives; general secretion is at first very much impaired, giving arid skin, confined bowels, and scanty urine; afterwards it is much increased, giving profuse sweating, diarrhœa, and copious diuresis—evacuations by no means critical, or resolutive of the disorder, but exhausting by impotent profusion. Frequently, after the morbid condition has existed for some time, Nature seems to rouse herself to an effort towards recovery by reaction, indicated by rigor. This may be followed by heat and sweating of a better kind, tending truly to resolve the disorder; from that time the symptoms begin to abate; and amendment advances satisfactorily, until the just balance of health is absolutely restored. But the salutary effort may fail; and then the downward course becomes more marked and rapid. The functions of organic life are more and more deranged. Respiration, before merely accelerated, becomes embarrassed and quicker in its draught; the pulse is more feeble, rapid, and indistinct; the cerebral functions become more and more impaired, as evidenced by delirium, which in its turn may be followed by coma; strength is speedily prostrated; secretion is again arrested—excepting perhaps diarrhœa, which now is truly colliquative; sinking in truth is established, and soon closes in death.

Causes.—The constitutional form may follow on the local; as inflammatory fever seems in most cases to be the consequence of local inflammation. An irritation of the bowels, if considerable, and at all continued, will not fail to induce general disorder, marked by some of the symptoms which have just been enumerated.

Or constitutional irritation may be the remote result of local inflammation. The immediate effect on the system is inflammatory fever; but serious change of structure, with suppuration, having taken place in the inflamed part, sthenic constitutional disorder passes away, and is merged in one of an asthenic type—Irritation. Hectic is one of the forms of this disorder (p. 42). And thus we see that although Irritation and Inflammation are morbid states distinct and incompatible, yet the one may pass into the other; in the general, as well as in the local form. Local irritation may be the means of inducing local inflammation; general irritation may supervene upon inflammatory fever. And in practice it is highly important to bear in mind the possibility of such transmutation.

Error in practice may effect a more serious change. If, in a case of constitutional irritation, a stimulant system of treatment be adopted prematurely and actively, the vascular system is probably roused into a sthenic effort. Inflammatory fever may ensue, but usually the attempt is only partially successful. It seems as if an endeavor were made towards a supremacy of vascular action over nervous; in other words, to induce inflammatory fever. The result, however, usually falls short of the aim, and the inflammatory subsides again into irritative fever, even more marked than before; a condition of the system formerly stated (p. 45) to be of an intermediate character between constitutional inflammation and irritation, and one almost invariably attended with much hazard to the frame.

Treatment.—1. As in the local form, the first and paramount indication is removal of the cause. Its efficient fulfilment is often alone equal to the cure. Resuming the illustrations given above as to cause—take away the intestinal irritation, and the constitutional disorder quickly follows; remove the hectic cause, and usually the fever speedily subsides.

2. Calm the nervous system. Of the calmatives, it is plain that those are to be preferred—at least in the first instance—which are not likely to over-stimulate the vascular system; for some, as opium, undoubtedly have this effect, while sedative to the nervous system; and our object is simply to subdue the ill we have, without endangering the occurrence of another still more serious. Irritative fever under any circumstances is a formidable evil, but, seizing on a system already low and worn, is likely to lead to the most disastrous consequences. Hyoscyamus is justly a favorite remedy. It is not powerful either as an anodyne or as a hypnotic, but "not poppy nor mandragora" soothe so unexceptionably; given in the form either of tincture or of extract; in the latter, sometimes usefully combined with camphor—when inflammatory tendency is not dreaded. One other advantage henbane possesses, in not interfering with the secretions, but rather favoring exhalation from both skin and bowels. Hydrocyanic acid is a powerful and often most satisfactory calmative, more especially in those examples of constitutional irritation following local irritation of the intestinal or gastric mucous membrane.

Conium is often useful, and may be given freely, unless palling on the stomach. Aconite and belladonna are also advantageous, in small doses, carefully conducted. In the advanced stage of the disorder, opium is highly beneficial, especially in the form of morphia; then we scarcely dread over-excitement of the vascular system; on the contrary, an increase of its tone is desirable; and we are glad to avail ourselves of the drug's powerful narcotic influence. Tendency to arrest of secretion may be obviated by a combination of drugs.

Sometimes the second indication may be happily conjoined with the first. Thus—again resorting to the example of intestinal irritation—we often remove the irritating agent, while at the same time a calmative is applied to both part [illegible] administration of castor oil with laudanum, calom [illegible] ll with henbane.

3. Restore secretio [illegible] horetics, diuretics, and laxatives are available for [illegible] e indication must be fulfilled gently and with caut [illegible] suddenness, might increase debility; tending to a [illegible] rder.

4. Support the syste [illegible] advances, the system gives way; and while it is o [illegible] e former, it is not less our duty to enable the latter to [illegible] its burden. Disinclination for food is by no means so [illegible] ammatory fever; not unfrequently the appetite is [illegible] metimes it is little if at all impaired. It is to be [illegible] tious and simple food—yet in moderation; given often, and in small quantities; for digestion is weak, and the additional source of further irritation by lodgment of undigested matter in the *primæ viæ* is certainly to be avoided. By and by, food may fail in its sustaining effect on the system, the stomach grows weary, and the digestion is weaker than before. More direct tonics are to be had recourse to; and the sedatives are laid aside; for now the nervous and vascular systems are both in a state of depression. Quinine, calumba, chirayta, &c., are given—yet cautiously; for all risk of the induction of irritative fever has not altogether gone. Effects are watched, and the tonics increased or diminished accordingly.

5. The disease advancing, both food and tonics become ineffectual. Stimuli are to be administered. Friction and heat to the surface; wine, brandy, ammonia, internally—in small doses, oft repeated. In the use of alcoholic stimuli, cautious management is most especially necessary. The first effect of a full dose is stimulant, the second just as powerfully sedative; marked depression follows on the marked excitement. It is our wish to produce and maintain the first, and by all means to avoid the second. Moderate doses are therefore given; small, yet sufficient to produce excitement; measured not by the wineglass but by the spoon. The effect of each dose is watched by a competent and assiduous attendant; and so soon as the stimulant effect begins to be departed from, and not before, the dose is repeated—in the same way as, in the local antiphlogistic prophylaxis, it will be seen that it is expedient to have the first effect of cold continuously maintained, while the second is carefully avoided. And not only is caution requisite to guard against the depressing effect of too large doses, at too long intervals; there is yet danger of over-stimulation; the opposite extreme may be reached; re-

action may be induced, in a turbulent, excessive, and unmanageable form; inflammatory fever is not likely, but irritative fever is far from impossible. In the last stage, opium is usually unadvisable. When much sleeplessness, jactitation, or undue efforts towards reaction exist, it may be given; but warily, and even with an unwilling hand; never in large doses, lest narcotism be approached, and sinking thereby accelerated.

Should overaction have been in any way induced, tonics and stimuli are to be desisted from for the time, and sedatives—perhaps with an antimonial—cautiously resumed.

It is very obvious how careful we should be, in not confounding this form of constitutional disorder with that of the inflammatory type. Antiphlogistics, more especially if recklessly and freely employed, must tend to confirm the disease, and probably hasten its fatal issue. And the same remark may be generally applied to local irritation also. "Bloodletting aggravates neuralgia, and relieves inflammatory pain; steel and arsenic aggravate inflammatory pain, and cure neuralgia."[1]

5. *The Shock of Injury.*

More or less depression of the nervous system, with a secondary and similar result on the sanguiferous, is usually the immediate result of mechanical injury inflicted on the living frame; proportioned in extent to the intensity of the external violence, the amount of the frame that is injured, the relative importance of the injured part in the general animal economy, and the previous state of the system. This depression is of an aggravated character, for example, when a portion of a limb has been crushed to jelly by a heavy weight; when a whole limb has been bruised, scalded, or burned; when an internal organ, such as the liver, kidney, bowel, lung, or brain, has in any considerable degree sustained lesion; when an injury, perhaps in itself not very severe, has been done to a frame either originally weak, or enfeebled by intemperance, by previous disease, or by either extremity of age. In military practice, bullet-wounds of the trunk are often judged of according to the amount of attendant shock; if depression be slight and transient, the probability is that the wound is but superficial, and at all events that the important internal organs have escaped; if it be both great and protracted, the prognosis is on the contrary unfavorable, the inference being that the wound has reached a vital part.

The *Symptoms* of nervous shock, after injury, vary from the slightest appreciable lowering of the vital powers, to complete syncope. Ordinarily, the patient falls, and lies helpless, cold, shivering, more or less unconscious, and when roused, probably incoherent; convulsions may supervene; the pulse is rapid, small, fluttering, indistinct; respiration is imperfect and sighing; nausea and vomiting are common—the latter not unfrequently preceding reaction, and seeming to be concerned in its induction; a cold sweat bedews the shrunk and pale surface; the features are collapsed; the countenance bears a somewhat anxious expression, or else, by entire muscular relaxation, is a vacant, death-like blank; the eyes roll wildly and restlessly, or else are fixed in an upward, listless stare, with the upper eyelid partially closed over the pupil; often the sphincters are relaxed, fæces and urine seeming to pass involuntarily; sometimes the secretion from the kidneys is suppressed; the cerebral functions may become wholly suspended, the heart's action may cease, and existence terminate.

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[1] Travers

Sometimes such symptoms abate rapidly, reaction quickly commencing and soon becoming completely established; sometimes they persist for hours, reaction proving both late and gradual; not unfrequently reaction fails, sinking is again progressive, the syncope is complete, and life becomes extinct.

Reaction—a more o [illegible] towards health—is usually preceded by a distinct r [illegible] y full vomiting. The nervous system is restored, and [illegible] proportionally relieved from depression. Sensatio [illegible] ce, gradually return. The patient becomes consc [illegible] inclines to inquire into it; his manner grows less [illegible] s eye is steady and expressive, his countenance i [illegible] features are more full and composed; secretion ag [illegible] the heart beats with gradually increasing power a [illegible] pulse becomes stronger and equable, and is felt disti [illegible] ties; heat comes back to the surface, and this parts [illegible] e appearance. The patient recovers himself, in short, [illegible] once more is an intelligent member of the world around him. This may be the result of Nature's effort, alone and unaided; or our art may assist in its induction.

Whether its commencement be spontaneous or not, its progress should always be watched most carefully. The action may advance favorably to completion, and proceed no further than attainment to the even balance of health; little or no extrinsic aid being required, either then or subsequently. Or it may overstep the bounds of health, and pass into disease; producing either irritative or inflammatory fever, according as the excess is of a sthenic or asthenic character. Or the salutary effort may be imperfect from the first, and asthenic throughout; partial restoration of pulse, consciousness, and general warmth, being quickly followed by relapse; a febrile accession occurs, but is of the typhoid character, tending to renewed prostration, collapse, and death. Again, in the case of lesion of certain internal organs, as the brain, premature occurrence of simple reaction may prove calamitous by escape of blood from the injured part—unfavorable to persistence or resumption of function. Even from an ordinary wound, the progress of reaction must be regarded; otherwise an inconvenient hemorrhage may ensue.

But the shock of injury may be considered practically as of two kinds —*mental* and *corporeal*. In the former, the patient—to use an ordinary phrase—is more frightened than hurt. The wound in reality is but slight, yet the attendant shock is great; it is however transient. Its origin was mental; alarm, being great and sudden, exercised a most powerfully depressing influence on the brain and general nervous system, which again lowered the circulation, and the combined result may have been a near approach to syncope. But so soon as the mind has been reassured—the injury having been seen and felt to be in truth trivial—depression passes away, and by reaction the balance of health is soon re-established. The practical importance of distinguishing between this and the more real shock, may be thus illustrated. Suppose a patient about to undergo an operation, on account of mechanical injury done to a comparatively unimportant part, and plainly laboring under depression of the general vital powers—shivering, pale, cold, breathing rapidly, with an alarmed expression, and almost pulseless. If this state is but of mental origin, the preparations for operation may be continued; a few words of kindness and comfort, with perhaps a mouthful of wine and water, will probably suffice to establish almost instant reaction. Whereas, if the cause be altogether unconnected with mental impression, the patient may be at once removed from the operating table to bed; inasmuch as some considerable time must necessarily elapse, ere the system can have recovered itself so far as to possess a tolerance of operation. The one form of shock is in its nature very transient, the other is to a greater or less extent enduring.

There are many cases in which both forms of shock are more or less combined; as can be readily imagined. For example, a man may be mortally wounded by an unexpected and unseen foe; the shock of the injury will be great, although entirely corporeal in its origin. A second may receive only a scratch, while he expected nothing but instant death; the shock will probably be serious, and may indeed amount to actual syncope; yet it is purely mental. A third may sustain a serious injury, from an assailant both seen and feared; and the shock will be intense; mental and corporeal impression both contributing towards the lowering result. In such cases as the last, it is practically useful to ascertain if possible—by inquiry into the history of the accident, and as to the natural temperament of the patient, as well as by carefully noting the existing symptoms—in what proportions the combination has probably occurred.

Treatment of Shock.—In the mental form, as already stated, reassurance and a little time are sufficient to recover the patient; the application of heat, with some cordial internally, hastening the event, if necessary. In the corporeal, two errors—in their nature very much opposed—require to be guarded against; foolish bleeding, and premature stimulation. A patient having received a fall, is probably found unconscious and incapble of motion; and the unwary practitioner is very apt to mistake such a state for the coma induced by extravasation. A vision of apoplexy, with its wonted remedy of venesection, passes on the instant through his mind; his lancet, as it were mechanically, leaves its case, and reaches a vein in the bend of the arm, or the jugular vein, or the temporal artery. No blood may follow the incision; and it is well; for loss of blood—a most powerful agent of depression—is not likely to prove beneficial when depression is already great and dangerous. By and by, reaction begins to be established; the pulse may be felt and counted, the skin becomes warm, and signs of returning consciousness appear; at this stage, bleeding is not unfrequently practised; and still it is premature. Nature now, however, is in a state of self-defence; and but little of the precious fluid escapes ere syncope again occurs, arresting the flow—a protest and a safeguard against the *malapraxis*. The time for bleeding is neither before reaction nor during its early progress; but after it has bee established, and when it threatens to advance to an inflammatory exces

Again, let us suppose that the case is not one of simple concussion, but that lesion of the cerebral structure has occurred. Perhaps the shock—for at first the symptoms may be those of concussion only—is of long continuance; hours may elapse, and yet the circulation is weak, and almost limited to the trunk. This is fortunate; for, during such a condition, hemorrhage is not likely to take place from the injured texture; and time is afforded for the completion of that beautiful process, to be afterwards described, by which Nature prevents loss of blood in many cases of injured vessels. When reaction does occur, and activity of circulation is restored to the brain, bringing with it return of function, no open vessels p xtravasation; and coma by compression has been h This is a felicitous adaptation of circumstances to th portant and salutary event; and let the surgeon l lmiration. But, not unfrequently, he tires of wa dministers stimuli at an early period to bring about r tely he is successful in his short-sighted aim; circulation is to the torn part, while its vessels are yet open; concussio rted into compression; and danger to life is increased ten er such circumstances—and they are of common occurrenc ourse to stimuli is strongly reprehensible. The practice m n all such cases prejudicial; and in not a few it will be certai

In the treatment of the shock of injury, then—and more especially when the head is the part injured—early bleeding and immature stimulation are both to be avoided. The injured part receives the mechanical adjustment that is necessary; and the patient is laid in bed, or elsewhere, as comfortably as possible; with the head (unless it be the seat of injury) in the first instance rather low, so as to favor return of arterial circulation there. The event is then carefully watched. Reaction may soon occur, without further aid from us, and may require even active means for its moderation. When it is tardy, and there seems to exist no reason why its retardation should be desirable, friction and heat are to be applied to the general surface; and should these fail, stimuli are then cautiously administered by the mouth—if the patient is able to swallow; beginning with simple fluids, such as hot tea or soup, and gradually ascending in the scale, if need be, to brandy and ammonia. The exhibition of these requires great care, when insensibility is complete; otherwise they may get into the air-passages instead of into the gullet, and suffocate the patient. In many cases, indeed, we must trust to other means; such as galvanism; or the application of powerful stimuli—as sinapisms, hot irons, blisters, strong ammonia—to the surface, with the double object of rousing the spinal system by reflex action, and courting sanguineous circulation towards the part irritated. But in the use of such remedies, again, it is to be remembered that sensation is for the time in abeyance; and unless we—as it were—feel for the patient, the applications are apt to be unnecessarily severe; proving very troublesome, and perhaps even dangerous, in their results, after reaction has been established—as by ulceration, sloughing, or extension of superficial inflammatory action. The ammonia, for example, of a smelling-bottle has often been carelessly thrown into the nostrils, producing sad disturbance there; during syncope, the patient is unaware of this fresh injury; but, very soon after reaction, the effects of the overdone remedy may largely predominate over those of the original accident. Lives have actually been lost by nasal inflammation, so induced, having extended to the cranial contents.

The internal use of stimuli must also be conducted with extreme caution, as to their legitimate effects: being desisted from so soon as circulation is restored satisfactorily; otherwise, danger by excessive reaction can scarcely be escaped. If inflammatory fever set in, along with local inflammation in the injured part, not only are all stimuli scrupulously withheld, but antiphlogistics are administered as circumstances may demand. If, on the other hand, irritative fever be the result, opium or other narcotics, in guarded doses, are indicated. And it is to be borne in mind that when the shock has been severe and protracted—more especially when is has occurred in a frame previously weak—the sthenic period of reaction is apt to be but short; the tendency is to gangrene locally, with typhoid seizure of the system; and in such cases the more powerful antiphlogistics must be employed sparingly, if at all. When the injury has been attended with great loss of blood, reaction is seldom or never of the sthenic form, but of the purely nervous kind—as will be described when treating of venesection; for the assuaging of this, a full opiate is most effectual.

Vomiting usually disappears before ordinary restoratives, along with the other symptoms of shock. Should it prove troublesome—as it sometimes does, with hiccup—it may be directly treated by a sinapism to the epigastric region, with small doses of the spiritus ammonia aromaticus. Naphtha, creasote, and prussic acid, are also useful.

Thus, the dangers of shock after injury are, 1. Continued depression, sinking, and death; to be met by restoratives; abstaining from bloodletting, and other sedatives, during the early period of nervous commotion. 2. Immature and excessive reaction, of a sthenic and vascular character; to be met by bloodletting, and other antiphlogistics; the use of restoratives being of course refrained from. 3. Excessive reaction, probably remote, of a nervous type; to be met by opiates and other calmatives, cautiously administered. 4. Asphyxia, or other disaster, by the use of stimuli and restoratives; to be avoided by care, prudence, discretion, and coolness, on the part of the practitioner.

6. *Delirium Tremens.*

This formidable disorder is one of peculiar interest to the surgeon; being, indeed, one of the most frequent causes of danger from wounds or injuries occurring in constitutions deteriorated by intemperance; and not unfrequently producing fatal results in cases of surgical affections otherwise of the most favorable character. It is, in fact, a disease of the nervous system peculiar to intemperate habits; and rarely, if ever, occurs, except when the brain has been habitually excited by alcoholic stimuli. It is to be observed, however, that positive *drunkenness* is not necessary for its production; the tone of the nervous system being readily undermined by doses of stimulants short of intoxication, when habitually taken, especially in weak and irritable habits. The accession may be during continued and, as it were, paroxysmal drinking; or it may be induced by sudden and complete interruption of the accustomed indulgence. And this latter circumstance must always be regarded, with a view to prophylaxis, in patients predisposed to the malady. Even after injuries certain to inflame seriously, the habitual stimulus must be prudently maintained.

Delirium Tremens, or a very similar condition, appears also to be occasionally induced by the habitual use of other narcotic substances; such as tobacco, opium, kind, however, are comparatively rare, at least in t

In its mildest phase, t stages, this affection pre-
sents itself merely as m of the depression which
usually follows a protr patient is restless, dejected,
often agitated, and easily mov undefinable feeling of op-
pression and anxiety; sleep is e mind is incapable of con-
centration, sometimes confuse d by transient illusions; the
body is also apparently incap tion; and there are slight
evidences of want of control ov les—very frequently tremu-
lousness of the tongue, or unste holding a pen. With these
symptoms, there is impaired appe breath, a constant bad taste
in the mouth, sometimes loathing of food; the tongue is white and pasty; the skin is cool, and readily bedewed with perspiration; the pulse is often natural in frequency, but usually very compressible. If, in this state, the mind be in any way agitated, or the body subjected to injury or operation of any kind, the confirmed disease is apt to be induced. Delirium sets in, usually of the furious kind; but subject, in this respect, to remissions and exacerbations. There is however almost constant confusion of mind; the movements of the limbs are tremulous and abrupt—often guided by erroneous ideas, or suggested by those spectral illusions which now begin to harass the patient; there are noises in the ears, and sights before the eyes, sometimes, though not always, of a frightful or extraordinary nature; the illusory ideas are seldom constant or fixed, but appear to succeed one another very rapidly; and frequently they have reference to some supposed supernatural occurrence, or demoniacal possession. In this stage, there is always extreme difficulty of procuring sleep; which, however, if procured, is generally the precursor of recovery. On the other hand, if the symptoms continue, a typhoid state is almost certainly induced; and a fatal event may take place, either by pure exhaustion or by coma.

In the confirmed disease, there is commonly more or less excitement of the pulse; which however is usually soft in character. In all other respects, the symptoms are those of bodily prostration; and this becomes greater as the disease advances. From this circumstance, and from the long-continued habits of the patient, a certain allowance of stimulants is almost always required in the treatment; and, on the other hand, bleeding and depletion of every kind are usually found to be remarkably ill borne. In consequence of this, treatment is mainly directed to the procuring of sleep, and the subduing of tendency to excitement. For both of these purposes, narcotics are required; perhaps the best combination being opium with hyoscyamus. The very large doses which may be given, with scarcely any effect, is a singular proof of the extent to which the constitution is modified by disease; engendering tolerance of the remedy. Where narcotics alone fail to subdue the delirium (as is not unfrequently the case), they may be combined with tartrate of antimony in small and repeated doses; care being taken, by the watchful administration of stimulants, to prevent the supervention of undue depression. Sometimes opium and belladonna are exhibited locally, with advantage; applied by means of vesication, along the spine. Chloroform, too, is occasionally serviceable, administered by inhalation; but mainly as a means of subduing paroxysmal excitement, and so favoring subsequent influence of the narcotics.

7. *Hysteria, Spinal Irritation, Hypochondriasis, Epilepsy, &c.*

We cannot enter at any length into a discussion of the disorders of the nervous system, above enumerated; and others, also, we must pass by, which are fully described in medical works. They are mostly of too complicated a character to be understood, without a more detailed description than could possibly be given here; and it will therefore be sufficient to advert merely to their leading characteristics, and especially to those which render them important to the surgeon.

Hysteria, not unknown in men, is for the most part peculiar to the female system. It commonly occurs in paroxysms, brought on by some mental emotion; and, in highly hysterical subjects, in whom the mind and temper are not well regulated, the slightest disturbance of equanimity will often prove a sufficient exciting cause. In its ordinary form, it is attended by spasms and irregular movements, and even by convulsions. There is commonly a sensation as of a ball or obstruction in the abdomen, rising towards the throat, and causing there a feeling of suffocation (*globus hystericus*). There is also irregular laughter, intermixed with fits of screaming or weeping, and other evidences of violent and unreasonable emotion. The patient often appears to be entirely unconscious, although there is good reason to believe that in most cases consciousness is not really absent; the violence of the disease being commonly increased by demonstrations of sympathy and interest on the part of bystanders; and, on the other hand, abating wonderfully, when the patient is left to herself. The paroxysms may last a considerable time; but their duration is usually not more than a few hours or minutes. Their resolution is often accompanied by a copious flow of limpid urine; and there remains only a feeling of weariness and languor. Sometimes, however, the affection passes into a temporary coma; or into various forms of trance or catalepsy. But these varieties are rare.

The irregular forms of hysteria chiefly interest the surgeon, from the frequency with which they simulate grave external affections; complicating the diagnosis, and often leading, in inexperienced hands, to very serious errors of treatment. In fact, there is scarcely any form of external or internal painful affection, scarcely any spasm, or functional derangement, which may not be simulated by this singular affection;

and this is all the more likely to be the case, on account of the habitual proneness to exaggeration and deception that often mingles itself, as it were insensibly, with the hysterical character. Diseases of the joints,[1] irritability of the mamma, spinal diseases, painful neuralgic affections, spasmodic cough, disorder of the larynx impeding respiration, difficulty of swallowing, difficult micturition—these are but a few of the hysterical affections which most frequently simulate or complicate surgical diseases, and against mistaking which the practitioner must be ever on his guard.

The greater number of hysterical pains are accompanied by tenderness on pressure, often extreme, at one or more points along the spine. This affection, which is not attended with swelling, redness, or any other appearance of inflammatory action, is called *Spinal irritation;* and should be looked for in e [illegible] ot explicable on ordinary surgical principles; whet [illegible] with hysterical symptoms. It is frequently, like all t [illegible] hysteria, accompanied and probably often caused by [illegible] r uterine derangement.

The treatment of hyste [illegible] ld always be, in the main, tonic; and will be modifie [illegible] the functional or organic derangements with which th [illegible]. Depletion and stimulation are both to be depr [illegible] stances; nor are narcotic remedies usually found av [illegible] nt good. The disease is seldom dangerous to life; [illegible] found most effectual are simple measures, such as the [illegible] pecially in the form of the shower-bath; a remedy which is perhaps oftener than any other followed by rapid resolution of the paroxysm, and one which may be also habitually used with advantage in the chronic forms. The administration of antispasmodic medicines, such as valerian and assafœtida, in combination with various tonics, regulation of the uterine functions, and the use of local soothing remedies, in the case of severe pain, are usually followed by a measure of success. But it is undeniable that this affection is sometimes one of the most obstinate and rebellious with which the practitioner has to contend; the successful management of it depending, to a very great extent, on regulation of the mind and temper by the patient herself, and on the gradual obliteration of old-standing and deeply-rooted habits of self-indulgence and caprice, over which neither medicine nor surgery have any control.

Hypochondriasis chiefly affects the male sex, and is usually associated with deranged digestive function. It presents itself under the form of lowness of spirits, with general depression and inactivity; generally attended by imaginary illness, and always by a disposition to lay undue stress upon symptoms actually present. This condition is in some respects the counterpart of hysteria, but is less under control of the patient; and, in fact, not unfrequently depends on disease, functional or organic, of some of the internal organs.[1] Like hysteria, it usually demands a tonic treatment; in which, change of air and scene is not the least important ingredient.

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[1] Sir Benjamin Brodie says—"I do not hesitate to declare that, among the higher classes of society, at least four-fifths of the female patients who are commonly supposed to labor under diseases of the joints, labor under hysteria and nothing else."

[2] Very often hypochondriasis is connected with deposits of oxalate of lime crystals in the urine; for the detection and treatment of which condition see the works of Prout on Stomach and Renal Diseases, Lond., 1849; Golding Bird on Urinary Deposits, Lond., 1846; and Dr. Begbie's Paper in the Monthly Journal for August, 1849.

Epilepsy is characterized by paroxysms of general convulsions, recurring at intervals, and lasting from a few minutes to half an hour—very rarely longer than this; accompanied by complete coma, foaming at the mouth, and great distortion of the features; generally instantaneous in accession, and, on disappearance, leaving the patient without any symptom of illness, or any recollection of the attack. This lamentable and obstinate disease is little liable to be confounded with any surgical affection; and deserves notice here chiefly on account of the attempts which have been made—sometimes successfully—to effect a cure by surgical interference, in cases which depend on depressed fracture, or on the supposed presence of an inward spiculum from the cranium.

Various other affections of the nervous system have at different times been considered as falling within the surgeon's province, and remediable by his art. Most of these are the result of injuries; and are considered in the "Practice of Surgery." Some forms of neuralgia, in so far as their surgical treatment is concerned, will be noticed afterwards in the present work.

In connection with the preceding section, the reader may consult the following works:—On *Nervous Affections in general, Irritation, and Shock*—Travers, on Constitutional Irritation, Lond., 1826; and 1835; Brodie on Local Nervous Affections, Lond., 1837; Marshall Hall on the Diseases and Derangements of the Nervous System, Lond., 1841; Todd on the Nervous System, in the Cyclopædia of Anatomy and Physiology. On *Delirium Tremens:* Watson's Lectures on Practice of Physic; Sutton—Tracts on Delirium Tremens, Lond., 1813; Armstrong and Pearson on Brain Fever from Intoxication, Ed. Med. and Surg. Journal, vol. ix.; (these, with Sutton's work, contain the first accurate descriptions of the disease); Bright's Hospital Reports, vol. ii, p. 15, Lond., 1831. On *Hysteria, Spinal Irritation*, and various other anomalous affections connected with this state, see the different Medical Text-books and Cyclopædias; and Dr. Laycock's interesting articles in the Edinburgh Medical and Surgical Journal for 1838. Also the work of Brodie above mentioned.

AFFECTIONS OF INTERNAL ORGANS IN CONNECTION WITH SURGICAL DISEASE.

The not unfrequent coincidence of serious internal diseases with affections apparently of a purely surgical character, is a circumstance of the greatest interest and importance to the practitioner, and well calculated to impress upon him the necessity of some degree of knowledge of his art in all its branches. Without such knowledge, he can never be secure in determining upon, or in performing any operation; or even in the treatment of the most ordinary injuries. For it has been shown by multiplied experience, that there is no wound, from phlebotomy to amputation; no concussion, from the smallest bruise to the most frightful fracture; no disease, from that of a finger to the caries of a hip-joint or vertebral column,—which is not very liable to be preceded, followed, or in some way or other connected, with disease of vital internal organs; so modifying diagnosis, prognosis, and treatment. Many examples of this have already been presented to the reader, under the head of *Constitutional Affections;* and many more will come under notice in the remaining portions of this volume. But it seems desirable here, to give as succinct a view as possible of the circumstances under which external disease may be thus complicated; not with the intention of entering into details, which will be more in place afterwards, but in order to complete the statement of those principles which it is the object of this chapter to unfold; and to impress a feeling of wholesome caution, in regard to surgical procedure in general, which will find abundant application as we proceed.

The coincidence of internal with external diseases, may occur under a great variety of circumstances. It may be purely a coincidence; or one of the diseases may stand to the other in the relation of a cause; or again, there may be an antecedent circumstance to which all are to be ascribed, as we have seen is the case in most constitutional disorders. In these cases, the effect of the internal on the external disease may be such as to modify its whole characters, and thus to make itself obvious to the most unwary and [illegible]ner; or, on the other hand, its influence may be so i[illegible]s not to be readily appreciable, till the shock and [illegible] of some great operation, or the supervention of som[illegible]ttack, shows the real weakness of the vital powers, [illegible]at more tolerance of injury has been looked for than [illegible]nternal organs warranted. We may illustrate this subject un[illegible]owing heads:

1. *Internal diseases may concur [illegible]lly with external disease.*— In this case they are commonly [illegible] at least of older standing than the surgical affection. It is [illegible] that a large proportion of individuals dying of any disease, [illegible]dical or surgical, especially if of advanced age, of dissipated [illegible] otherwise exposed to the causes of morbid action, exhibit marks of either absolute or progressive disease in vital organs, contracted at an earlier period than the fatal affection. Such departure from health may include a great variety of organs. In this country the most common diseases are those of the lungs, particularly tubercular affections; the traces of which are found in a very large proportion, probably even in a majority of persons dying in advanced life. Next to the pulmonary lesions, diseases of the kidneys and of the heart, in both sexes—and, in women, of the uterus—are the most frequent; and important disorders of the brain, liver, intestines, and spleen, are far from being of rare occurrence. Many of these affections are found to have undergone cures; others may be in a state of progress at the time of death, and yet apparently unconnected with the fatal event; while, in many cases, they have obviously hastened this, either by imparting to the fatal disease a more formidable character, or by acting as either its predisposing or exciting cause.

It is obvious that the chances of an operation, or other violent interference with the natural condition, as likewise the prognosis and treatment of many external maladies, must be constantly modified, and that to a very considerable extent, by such antecedent circumstances. The presence of Bright's disease of the kidney, of tubercular phthisis, of organic disease of the heart, of chronic affections of the brain or liver, may not be inconsistent with a certain amount of health, and enjoyment of life, under the usual conditions; but they form a most dangerous complication of any severe injury, and are often sufficient to render the chances of an otherwise justifiable operation worse than those of the disease it is intended to remove. Hence, every patient about to be subjected to severe operative procedure, should be submitted to a medical examination, as satisfactory as his state will permit; and the surgeon's hand should be guided by as ample a knowledge as possible of his patient's previous constitution, diseases, and predisposition. Even if the operation should be determined upon, in unfavorable circumstances, the precaution will often enable us to foresee and guard against calamities, which might otherwise have been unnoticed and unlooked-for till too late for either prevention or relief.

Internal diseases may of course arise accidentally, during the treatment of surgical cases; presenting the most varied forms, and producing the most varied effects. It is impossible, however, to give any general rules, applicable to such cases; which must be met by the care, vigilance, and general knowledge of the individual attendant.

2. *The internal disease may be the cause of the external.*—Examples of this are familiar to every practitioner. They often come first under the eye of the surgeon, on account of the predominance and easily appreciable characters of the external symptoms, as compared with the more latent internal disorder. Nevertheless, to the latter, usually, attention must mainly be directed in treatment; while the other is of course not neglected.

Thus an abscess in the groin, or beneath the fascia of the thigh, may be connected with deep-seated disease of the vertebral column; and may be readily mistaken, by the unwary or ill-informed surgeon, for a mere external affection. Abscesses in the neck may communicate with the lung—though this is rare; less seldom they lie close upon, or are found in connection with, the aorta, or some other great vessel, which may be at the same time the subject of disease. An abscess of the thoracic parietes may appear to be localized there, and yet may have been formed in consequence of a collection of matter in the pleura. An inflammation of the abdominal parietes, leading to abscess, may result from disease in the liver; or may be in connection with the intestines—ultimately causing fæcal fistula. Many ulcers also, especially of the indolent kind, owe peculiar characters, or even their existence, to Bright's disease of the kidney, or to organic affection of other internal viscera; a circumstance which of course very much modifies the prognosis, as well as the treatment. Absorption of the sternum, and other diseases of external bones, may be caused by aneurisms pressing upon them from within; the non-recognition of which might lead to immediately fatal consequences. Finally, functional disorders requiring or appearing to require surgical aid, may be essentially dependent on organic or other internal affections; as spasm of the larynx, possibly requiring tracheotomy—in children dependent on intestinal irritation, in adults on aneurisms or other tumors interfering with the pneumogastric nerve. Another example is partial paralysis of a limb from an internal cause; and there are a variety of similarly related affections, which will be mentioned in their order.

3. *The external affection may precede and give rise to the internal.*—The great number of secondary diseases which are liable to follow external inflammatory affections, and operations, is well known to sur-

geons. Experience has shown that a very large proportion of deaths after amputation are caused by a peculiar poisoning of the blood, leading to the formation of inflammations and abscesses in various internal organs, especially the lungs and liver. The same symptoms not unfrequently arise from very slight external lesions, such as wound of a vein in bleeding, or some accidental breach of surface, in itself most trivial. The effect of many poisoned wounds, also, is a species of spreading inflammation which readily extends over a large surface, and involves.very frequently internal organs in its progress; and the same thing may be said of erysipelatous inflammation, which not unfrequently undergoes an extension or transmutation into an affection of some internal part.

The special seconda [illegible] h particular surgical operations and diseases are [illegible] full consideration hereafter. But, in the meantime, [illegible], that almost all secondary inflammations are apt t [illegible] insidious characters; being masked partly by the cons [illegible] ms which always follow an operation, partly by the pe [illegible] r of the inflammation, and often also by the asthenic co [illegible] patient, and the attention necessarily directed to the [illegible] primary affection. Such diseases, therefore, require par [illegible] for their recognition, and usually also very great skill and c [illegible] ion in treatment.

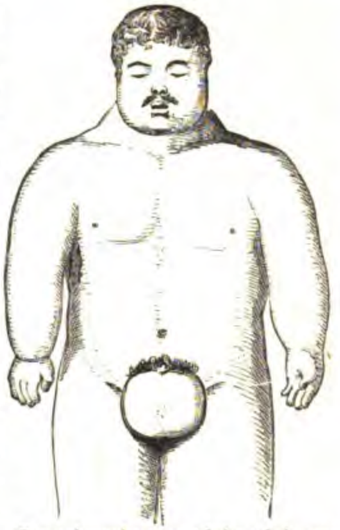
4. *The external and internal diso [illegible] ty be produced by a common cause.*—This is perhaps the most usual mode in which internal diseases occur in surgery. It comprises the whole of the constitutional affections which have been discussed in the former part of this chapter; and likewise a vast variety of other diseases, which, although commonly called local, are probably owing, in a greater or less degree, to causes acting generally throughout the system. It may indeed be doubted, whether almost any inflammation, except such as is the effect of injury, external or internal, can be viewed as being altogether unconnected with some constitutional source; and the cause which renders an individual liable to one disease, not unfrequently brings others in its train. Instances of such association of diseases are of constant occurrence. Thus aneurism of an external artery is, very commonly, but one indication of disease in the whole arterial system; and if, in this case, an internal aneurism be detected—say, in the aorta—not only is the prognosis as regards the success of an operation on the external aneurism much modified, but the propriety of undertaking it at all is rendered very doubtful. Another instance of a disease of this kind is senile gangrene; which often depends on a wide-spread affection of the arterial system.

A local disease may be such as, from its position alone, to involve both external and internal organs simultaneously. Thus caries of the petrous portion of the temporal bone may produce an inflammation of the external ear, at the same time that it is causing dangerous disease of the membranes of the brain; and attempted cure of the former affection may only expedite the destructive course of the latter. Again, a local disease may have become so connected with the habit, as it were, of an individual constitution, as to render its sudden removal dangerous. In some instances, for example, the removal of piles has given rise to dangerous hemorrhage into internal organs, or to other diseases which had been restrained by the local, and in this case salutary, discharge.

But among the cases requiring the greatest caution, under this head, are those of external injuries; especially when of a violent or concussive character. There is always a fear, in such cases, that an internal organ may be injuriously affected; and an external wound or fracture may be a matter of small consideration indeed, when compared with a laceration of the brain, liver, or other vital part. Deep-seated lesions are very apt to be overlooked in the first instance, from the shock which attends the injury masking all peculiar sensations; and they should be made the subject of very careful inquiry, so soon as the patient has recovered his consciousness.

Even when not produced by extreme violence or concussion, wounds may be inflicted in such a manner as to cause effects of a serious character on internal organs. In illustration of this, we may instance the formidable effects in wounds of some of the greater veins, arising from the admission of air into the circulating blood; a lesion which has often been followed by instantaneously fatal consequences, during the extirpation of tumors, or other operations in the axilla or neck. Thus, too, wounds of the lung are apt to be followed by many serious and fatal accidents; the admission of air to the pleural cavity being occasionally productive of immediate death, especially when there has been previously a diseased state of the lungs on one or both sides. The state of general emphysema of the areolar tissue—its distension with air—which is apt to supervene on wounds of the air-passages, occasionally results in serious consequences; producing frightful inflation of the whole body, and requiring prompt surgical interference to prevent suffocation. Injuries of the abdomen may lead to communications of the intestinal cavity with either the peritoneum or the external surface; producing, in the first case, peritonitis of a violent and uncontrollable description; in the second, a fistulous opening, which can only be closed by operative procedure.

Fig. 6.



General emphysema, of the whole surface, after wound of the right side of the chest. The patient *was* a *light* dragoon. After Larrey.

Such are a few illustrations of the internal accidents liable to occur in surgical practice. They are given at this early period, by way of caution; and because they form a not inappropriate conclusion to a chapter on Surgical Medicine.

CHAPTER II.

INFLAMMATORY ACTION AND CONGESTION.

THE INFLAMMATORY PROCESS.

INFLAMMATION, the source of much evil, medical as well as surgical, may be defined: An alteration in the healthy structure and function of a part, accompanied by a perverted condition of the blood and capillary bloodvessels; ordinarily attended with redness, pain, heat, and swelling; and inducing more or less febrile disturbance of the general system.

But this term has, in my opinion, been made to include too wide a range of action—from tl [illegible] n of what is healthy, to the most disastrous results oi [illegible] endering the cause of simple effusion one and the same [illegible] ration, ulceration, and gangrene; uniting, as if in or [illegible] tion, the healing of a wound with its gaping and su [illegible] ual enlargement of a part, with its destruction and [illegible] of a portion of bone, with the formation of its subs [illegible] l reunion of a broken limb, with the suppurative arrest a [illegible] he callus—the infliction of an ulcer, with its process of heal [illegible] all, however dissimilar, declared the offspring of one common paren [illegible] nflammation.

The practical confusion and tendency to error, which inevitably result from such a state of things, seem full warrant for the surgeon to attempt a division of what is so extensive and varied, into its component parts; and, considering each apart, to inquire whether separate causes may not thus be found to suit the results so widely different.

As a suitable general term, comprehending the whole range of action, the phrase "THE INFLAMMATORY PROCESS," may be employed. And I would limit the term INFLAMMATION to what is ***essentially morbid;*** that is, at variance with healthy function and structure. The blush of shame, or the red spot of hectic, is not the same with the fiery swelling of erysipelas; increased vascular action in the mamma giving milk, is different from that thoroughly perverted vascular action which attends arrest of the secretion, and structural change of the organ; the simple turgescence which at once closes a flesh wound, is an action far short of that which renders its lips separate and swollen, pouring out a copious purulent discharge. The one is something not at variance with health: the other is Inflammation.

From health to true Inflammation is not one step, at once attained, but a transition gradually effected; the time occupied varying according to circumstances. In some cases a very few hours suffice; in others, days may have elapsed, and yet the process is incomplete.

The transition may be conveniently subdivided into three stages:—1. Simple Vascular Excitement; 2. Active Congestion; 3. True Inflammation. The exact details of the process cannot be stated with certainty; but are, probably, nearly as follows:

Theory of the Inflammatory Process.

Let us take a common surgical example; the application of some acrid substance to the skin. Each component texture of this part may be affected, so soon as brought into contact with the irritant; yet it is not improbable that one texture may be involved more decidedly than the others. This one is the nervous; and hence immediate pain, by the effect on its sensory portion. An impression is thus conveyed from the part to the nervous centre; thence follows a stimulus to the vascular tissue of the part, already roused by the direct influence of the irritant; and that stimulus is in due time obeyed.

The time which elapses between the application of the exciting cause and establishment of the vascular action thereby induced, is termed the period of *Incubation;* varying as to duration; in some cases very brief; in others protracted; always valuable with regard to treatment.

I. The process commences with determination of blood[1] to the part; and that fluid is sent through it with an augmented velocity. At first, the capillaries and minute arteries—those vessels mainly concerned in the change—are of diminished calibre; a vital change which may result from an inherent contraction of their walls. The capillary coats being held to be of the same nature as involuntary muscular tissue, this contraction may be not unreasonably considered analogous to Spasm; while the dilatation that succeeds may be likened first to Relaxation, and afterwards to Paralysis. But soon this spasm or increase of tone in their coats passes off; they gradually yield before the increased and increasing flow, while yet the rapidity of this is not sensibly diminished. After a short time, the spasm has not only disappeared, and the wonted capacity been regained, but dilatation beyond the normal standard is begun. Capillaries which previously contained but single files of the red corpuscles, now admit of them rolling through in masses; and these come crowding in. In consequence, vessels formerly invisible are now

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[1] DIAGRAM OF BLOOD.

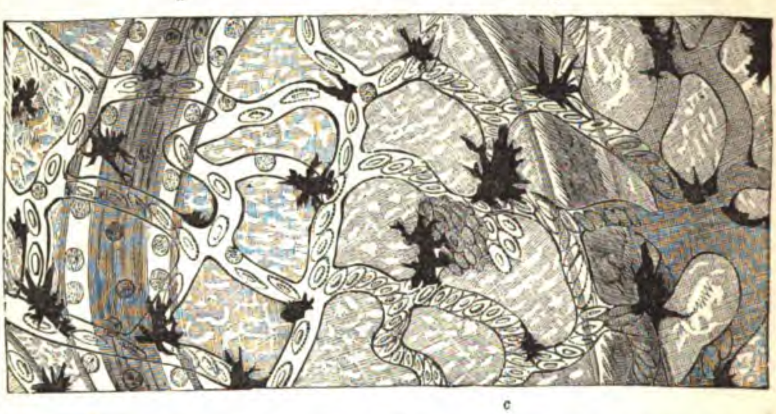
Chemical Components.

LIVING BLOOD.	*Liquor Sanguinis.*	Water. Various salts. Fatty matters. Extractive do. Albumen.	*Serum.*	COAGULATED BLOOD.
		Fibrin.	*Crassamentum.*	
	Red Corpuscles. *Colorless Corpuscles.* *Granules.*			

The solid portion of living blood, containing iron, and carrying oxygen, may be said to minister specially to respiration; while the fluid part, or plasma, is peculiarly concerned in the function of nutrition.

seen plainly; and the accelerated motion of the general current is as yet but little abated. As dilatation increases, however, the flow tends to become more and more retarded. In such a state of matters, it need afford no surprise to find a tendency to unusual transudation; in other words, along with an increased circulation, comes an increase of the ordinary function of the circulation. The blood parts with a portion of its contents more liberally than in quiet health. The transudation may be chiefly serous; or the liquor sanguinis is found on open surfaces, and in interstitial spaces. The natural function of the part is exalted. If this be secretion, the secreted fluid is increased in quantity, yet with its normal characters scarcely if at all changed. Nutrition is exalted also; and the fibro-areolar tissue is fuller than before, giving slight increase of bulk.

Fig. 7.



An exact copy of a portion of the web in the foot of a young frog, after a drop of strong alcohol had been placed upon it. The view exhibits a deep-seated artery and vein, somewhat out of focus; the intermediate or capillary plexus running over them, and pigment cells of various sizes scattered over the whole. On the left of the figure, the circulation is still active and natural. About the middle it is more slow, the column of blood is oscillating, and the corpuscles crowded together. On the right, congestion, followed by exudation, has taken place, constituting inflammatory action in the part.

a. A deep-seated vein, partially out of focus. The current of blood is of a deeper color, and not so rapid as that in the artery. It is running in the opposite direction. The lymph space on each side, filled with slightly yellowish blood plasma, is very apparent, containing a number of colorless corpuscles, clinging to or slowly moving along the sides of the vessel.

b. A deep-seated artery, out of focus, the rapid current of blood allowing nothing to be perceived but a reddish-yellow broad streak, with lighter spaces at the sides.

Opposite *c*, laceration of a capillary vessel has produced an extravasation of blood, which resembled a brownish-red spot.

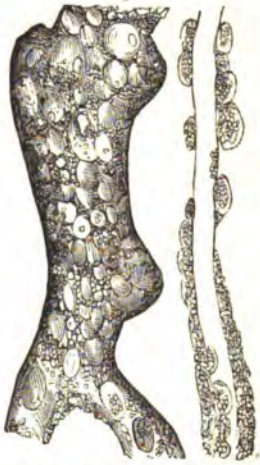
At *d*, congestion has occurred, and the blood corpuscles are apparently merged into one semitransparent, reddish mass, entirely filling the vessels. The spaces of the web, between the capillaries, are rendered thicker and less transparent, partly by the action of the alcohol, partly by the exudation. This latter entirely fills up the spaces, or only coats the vessel.—BENNETT.

Thus is constituted the first stage, *Simple Vascular Excitement;* not necessarily inconsistent with health, but rather its mere exaltation; synonymous with the *Vital Turgescence* of some Physiologists. The part contains an increased amount of blood; its circulation is unusually active; there is a marked tendency to increased exudation, partly serous, partly of a plastic kind; and what is exuded differs little, if at all, from the ordinary liquor sanguinis.

The exciting cause having been removed, this condition may soon subside; and the part regains quiescence. Or, the exciting cause remaining, the disturbance is sustained, yet without proceeding to a higher grade; and a salutary result is probably secured thereby. For instance, it is by the continuance of such simple exaltation of function that the conjunctiva resents the presence of a grain of sand, and often succeeds in washing it away by increased serous effusion. But, the exciting cause remaining—or being severe in its nature, though of brief application—there is neither abatement, nor simple maintenance of the changed condition, but advance; and this brings us to the second stage.

II. *Active Congestion.*—The vascular commotion extends on the cardiac side of the affected part; the arterial trunks feeding it have partaken in the excitement, have begun to enlarge, and are pulsating with an unwonted energy. More and more blood is sent down to the part, and the capillaries and minute arteries begin to fail beneath their burden. Hitherto they were simply dilated, yet apparently controlling the circulation of their contents; but now tone in the vascular coats is giving way, and enlargement is about to be merged in over-distension.[1] Partly from this cause; partly on account of change in the blood itself, which seems more viscid, with its corpuscles less distinct; and partly also from an increase of vital attraction between the blood and surrounding parenchyma—the circulation loses its acquired rapidity, and becomes slower even than in health. The red corpuscles are no longer limited to the central current, but encroach more and more on the lateral and clear "lymph spaces." Exudation is more copious than in the previous stage, and of a different kind. It consists chiefly of liquor sanguinis; and this is altered from the healthy standard. The fibrin is increased, not only in quantity, but also in plasticity, or tendency to become organized.

Fig. 8.



Two vessels coated with granules, nuclei, and compound granular corpuscles. Example of Exudation.—BENNETT.

Increase of exudation may be explained, in part, by the supposed increase of vital attraction between the blood and the surrounding parenchyma. Attenuation of the distended coats of the vessels, also, obviously favors escape of their contents.

The natural function of the part is not simply exalted, but begins to be perverted: for example, secretion is not only increased, but changed in its character. By fibrinous interstitial deposit, the texture of the part is softened and enlarged. The "formative power," as it is termed, is disordered; and the supply of plastic material is greater than can be usefully and normally appropriated by the implicated tissues.[1] In other words, nutrition, or the normal and vital relation which subsists between the living tissue and nutrient materials contained in the blood, is becoming more and more disturbed. And this, perhaps, constitutes the most important part of the inflammatory process; leading ultimately to change of structure, more or less permanent, and more or less inimical to resumption or continuance of normal function.

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[1] "Atony and flaccidity of bloodvessels may become a cause of impediment to a current through them, not by preventing these vessels from actively contracting on their contents, but by removing that tone by which the vessels maintain the calibre and the tension best calculated to transmit onwards the force of the current. Vessels thus weak and inelastic, instead of equably conveying the current, become distended, lengthened, and tortuous in receiving it; and by their very mass, as well as by their inelasticity, they partly break the force of the current, and partly turn it into other channels."—WILLIAMS' *Principles of Medicine*, p. 207.

Thus is constituted Active Congestion; the arterial trunks in increased play, but the circulation becoming slow in the part; its vessels beginning to be overdistended and losing tone thereby; its blood undergoing change, the fibrin espe l, both in quantity and plasticity; exudation of li lace, more or less copiously; function and nutrition aving the confines of health, and have, indeed, alrea s into the territory of disease.

This action may resolve after th of its simple exciting cause; or it may be sustained for some the healing of wounds and the closing of ulcers; or it may

III. *True Inflammation.*—The hich, in the preceding stage, had begun in the blood, is now c The overdistension of the capillaries is established; the capi er is for a time gone—perhaps in consequence of diminution or actual suspension of their nervous influence; and the coats of the capillaries and other vessels are spongy, softened, and impaired in cohesion, being themselves the subjects of structural change. The languor of circulation approaches stagnation, and at some points this has actually occurred; every part of the distended capillaries is occupied by crowded colored and colorless corpuscles. And this crowding and obstruction may be occasioned, as formerly stated, by viscidity of the blood, by increased vital attraction between the blood and the parenchyma, and by increased vital attraction in the corpuscles of the blood to each other. Altered liquor sanguinis is exuded in profusion. The attenuated and softened capillaries also give way in their coats; and from the lesion, blood is extravasated in mass. Suppuration is in progress, by extravascular degeneration of the fibrinous exudation, or—as some suppose—by a secretive elaboration of it ere yet it has left the vessel. The parenchyma, infiltrated by liquor sanguinis, pus, and blood, softens, and is broken up; and the disintegrated texture becomes mixed with the escaped contents of the vessels. The formative power has ceased; and the opposite condition, a tendency to disintegration, from diminution of vitality, has become established. Disorder of function is complete; secretion, for example, being in the first place arrested, and, when restored, more vitiated than before.

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[1] "The various solid tissues which are in continual process of change, more or less rapid, derive the materials of their reconstruction from the blood, especially from its fibrin; which they have the power, by their vital endowments, of causing to assume their own respective forms of organization. The vitality of the tissues in any part may vary in its degree; so that their formative power may be increased or diminished. When their formative power is increased, the process of nutrition is performed with unusual rapidity, and the fibrin of the blood is rapidly drawn from it; but when the formative power is diminished, the process of reconstruction is slowly and imperfectly performed, and the demand for fibrin is less."—*Brit. and For. Med. Review*, No. xxxv. p. 102.

In the circulation of the part truly inflamed, all is sluggishness and stagnation; but that of the parts around is unusually active. The arterial trunks in the vicinity continue to play with increased energy; blood continues to be sent, but cannot now be transmitted in its direct course: in the inflamed part it meets an obstruction, and, being sent round another way, throws a stress on the collateral vessels; these, however, retain vigor sufficient for the augmented labor, and pass the current briskly round. But, in their turn, they themselves may be overborne by an extension of the disease; and thus the course of circulation may be rendered, at each such extension, more and more circuitous.

While the apparatus of deposit is thus unusually busy, that of absorption is in abeyance. During inflammation, the lymphatics and minute veins do either little or nothing as absorbents. On yielding of the disease, however, not only does effusion begin to abate; absorption again comes into play, and that actively; and by its means the part is often restored nearly, or altogether, to its former state. During inflammation of a serous membrane, for instance, a large amount of liquid effusion often rapidly accumulates within its cavity; so long as the disease persists, that fluid either remains stationary or receives an increase; but so soon as the inflammatory process has fairly given way, and resolution is in progress, the effusion plainly diminishes, almost *pari passu;* and in two days, or perhaps in but a few hours, it may have in great part disappeared.

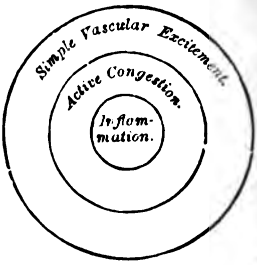
The inflammatory change of the blood is important. 1. The liquor sanguinis is increased in relative quantity, and its serum is said to contain an unusual amount of albumen. 2. The fibrin is increased in quantity; both actually, and relatively to the red corpuscles. The proportion of serum is diminished, probably in consequence of effusion. 3. The red corpuscles are relatively diminished in number; and their tendency to aggregation is augmented. 4. The colorless or "lymph globules" seem to be frequently increased in numbers; but this change is by no means essentially connected with the inflammatory process, as some have supposed.

This alteration of the blood—begun in the second, and completed in the third, or true inflammatory stage—is at first a local act, effected in the part inflamed; but this laboratory, if continued thus in operation, may ultimately involve the whole circulating fluid in similar change.

Such is Inflammation Proper. Blood much altered; stagnant, or tending to stagnation. The capillaries overdistended passive tubes; their coats spongy, soft, and lacerable. The neighboring collateral circulation unusually active. Copious exudation of liquor sanguinis; extravasation of blood, by lesion of the capillary coats; absorption in abeyance; nutrition and function wholly perverted. Structure changed; texture softened and enlarged. Suppuration in progress; and part of the texture breaking up. Nothing healthy, or consistent with local health; all essentially disease.

This state is not at once established, so soon as the period of incubation has passed away; but, as already stated, is approached by a process of transition more or less gradual. The previous stages may be either short or protracted, but can, in no case, be proved absent. When the process is somewhat tardy, its compound nature is the more distinct.

Take, for illustration, the vaccine pustule; an inflammation resulting from a poisoned wound, and gradually attaining to its consummation. The exciting cause is applied, and for a time seems to be inoperative; three days commonly elapse, without the appearance of vascular excitement; and this is the period of incubation. On the fourth day, the *papular* condition is established; commencing with simple excitement, and steadily verging towards active congestion. During the four following days, the *vesicle* is formed—the result of the crescent second stage of the disorder; the vesicle at first containing a serous fluid, which afterwards becomes of a more glutinous character by exudation of the liquor sanguinis. On the ninth day, the *pustular* formation is attained; and not until shment of True Inflammation been completed. So lar disturbance ordinarily su t slowly recovers.



l progress, advancement is us he centre; and, supposing a section ma he inflammatory disk, the accompanyi m may conveniently illustrate the st e part. The outer circle representing Vascular Excitement, whose characteristic on is serous; the second, Active Cong with exudation of plastic liquor sanguinis, within the inner circle, True Inflammation, denoted by more or less extravasation and destruction of texture, and the formation of pus in progress. Thus True Inflammation, structurally considered, consists of suppuration, actual or imminent, surrounded by fibrinous deposit, and that encircled by effusion of serum.

Every day's experience illustrates this. In the detection of deep abscess, for example, the subcutaneous areolar tissue is found œdematous; beneath this a firm hardness is felt; while within this, again, is the site of suppuration.

It has often been disputed whether Inflammation is caused by increase or diminution of vital strength in the part—an excitement or a debility; and both extremes have been tenaciously held and argued. According to the preceding account, the fact may be said to lie nearly midway between the disputants; the morbid process being found to commence with excitement, and probably with an actual exaltation of the part's vitality; this, however, proving usually of short duration, and succeeded by growing debility and much ultimate prostration. True Inflammation having been established, vital *power* is sunk very low. And what is worse, from this overthrow the part, once truly inflamed, never wholly recovers, but ever remains both more prone to disease and less able to control it; a fact which it is of much importance that both patient and practitioner should bear in remembrance.

Local Symptoms of the Inflammatory Process.

The consecutive changes which we have endeavored to describe, and whose completion constitutes true inflammation, are ordinarily accompanied and indicated by certain signs: redness, swelling, heat, pain, throbbing, increased sensibility, disorder of function, arrest, and change of secretion.

1. *Redness.*—The more fully a part is injected with blood, the redder is its hue. An inflamed texture, as we have seen, has its amount of blood much increased; and its color is necessarily heightened thereby. And not only are the vessels unusually gorged with blood; that blood is unusually red; much of the liquor sanguinis having moved on from the field of actual or threatened stagnation, leaving the overdistended vessels filled chiefly with an agglomeration of corpuscles. The *cause* of redness, then, is obvious.

The extreme vascularity of certain parts when inflamed, the conjunctiva for example, has been supposed to depend in part on the formation of new vessels. But it is not so; at least in the first instance. Minute capillaries, in health, carrying the red corpuscles in but single files, are invisible to the unassisted eye; inflamed, they are dilated, burdened with corpuscles in mass, and plainly seen; appearing to have grown up suddenly by a new creation, but being in truth only an enlargement of texture previously existing. The formation of new bloodvessels in fibrinous deposit, is a gradual and never an immediate process; as will be explained in the proper place. Ultimate increase of vascularization is frequently connected with inflammation; but it is incompatible with the true inflammatory crisis, which is adverse to all formation of tissue, and is suppurative and destructive.

The *degree* of redness varies according to the natural vascularity of the part, and the amount of active congestion attending the disease; or, in other words, according to the degree of engorgement, and the number of vessels which are engorged. It is a familiar test of the violence of the disease, in its early stage, to look to the amount of redness. And, again, we find an inflamed tendon less florid than inflamed skin; inflamed skin less red than inflamed mucous membrane.

The *tint* varies according to the character and accompaniments of the inflammation. A bright arterial red is exhibited by what is acute and sthenic; the chronic and asthenic is denoted by a dark, venous, or purple hue; great attendant biliary derangement gives a yellowish red, as in bilious erysipelas.

The color of an inflamed part is usually modified by the circumstance, that the distended vessels almost always give way; and extravasation thus takes place into the intervascular spaces. A familiar instance of this is known to the physician, in the rusty sputum of pneumonia; the effect of extravasation into the air-vesicles of the lung.

The *extent* and *form* of redness vary; sometimes limited to but a spot, as in the pustule or phlegmon; sometimes occupying a large space, as in erysipelas, and in the corresponding affection of mucous membrane. Sometimes in one unbroken sheet, as in erysipelas; sometimes in lines or patches, as in affection of the veins and lymphatics. Sometimes gradually lost by diffusion in the surrounding normal hue, as in phlegmon; sometimes carrying an abrupt bright margin, as in the erratic erythema.

One of the most important characters of inflammatory redness is its slight liability to *sudden* remission or exacerbation. Other redness may come and go, as the blush of shame, or the glow of warmth; but that of inflammation is fixed. By the pressure of a finger it may be made to disappear momentarily, but the pale dimple is quickly filled up and colored as before; all trace of the touch almost instantly vanishes, like the passing of breath from a mirror. The patient may be bled to syncope, and the general surface grow pale as marble; but this will not yet blanch the inflamed part; its redness remains until the disease which caused it shall have passed away.

But not only has it no flitting tendency; it must be *conjoined* with other symptoms. A crimson spot on the hectic cheek is sometimes fixed there, with little or no alteration; but there is neither pain nor swelling; it is not conjoined with other signs; it is not inflammatory.

2. *Swelling.*—Unwonted accumulation of blood will alone occasion this in the part inflaming. But as a symptom of the inflammatory process, swelling is mainl [illegible] of a portion of the vascular contents into the intervas [illegible] earliest stage, the effusion is chiefly serous. In th [illegible] quor sanguinis exudes, or fibrin more or less separ [illegible]; and this fibrin is of high plasticity. [illegible] third stage, the fibrinous deposit is [illegible] ed, but of impaired plasticity; wit [illegible] ixed blood, extravasated in mass, the r [illegible] vascular lesion; and ultimately puri [illegible] rmation is more or less advanced. S [illegible] t, again referring to the diagram: C [illegible] y we have a soft fluctuating swelling, where there are blood and pus; surrounding this, a dense and unyielding circle, somewhat diffuse, and usually less prominent than the centre—the result of plastic fibrinous accumulation; and exteriorly to both, a soft pitting œdema, more or less extensive, according as the areolar tissue has been filled by serous effusion. The combined result is softening of texture, and impairment of cohesion, as well as enlargement of the part.

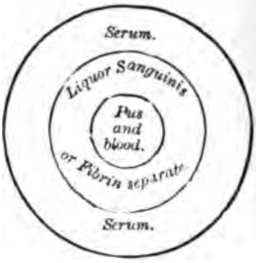
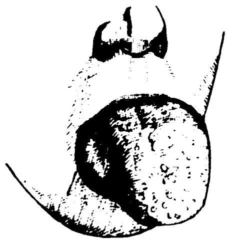


Fig. 9.



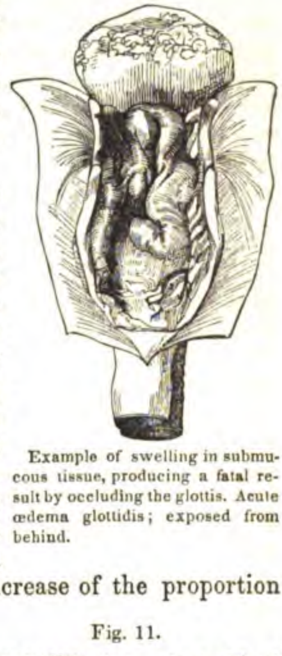
Example of inflammatory swelling. Tongue swollen, by glossitis.

Swelling, like redness, will not alone indicate inflammation; it must be *conjoined* with other symptoms. In simple œdema, there may be much swelling; yet there is nothing of the inflammatory process.

It is also of *gradual* and *recent* formation; not suddenly developed, as is the bulging of a hernia or dislocation, or the sanguineous infiltration immediately consequent on a blow; nor of a tedious growth and ancient origin, as is the genuine tumor—fatty, fibrous, or malignant.

The *tendency* of swelling is beneficial or otherwise, according to the part affected. If this be internal, of delicate texture, and important in function, swelling there may prove in the last degree injurious; as in the brain. Or a part, itself comparatively of little importance, may be in the immediate vicinity of one which is of the greatest; and enlargement of the former may react on the latter most injuriously. Swelling of the orbital areolar tissue will so affect the eyeball; inflammatory tumor of submucous tissue may fatally occlude a mucous outlet—as the glottis. On the other hand, swelling is usually a fortunate occurrence, and encouraged as such by the surgeon, if the part be situated externally—as the ordinary subcutaneous areolar tissue; or if it be neither itself of delicate texture, nor endowed with function essential to the animal economy, nor closely connected with one which is either or both—as the textures occupying the intermuscular spaces. The overdistended vessels are relieved of part of their burden; and an opportunity, varying according to the extent and rapidity of the exudation, is thus afforded them of recovering from debility, regaining their normal tone, and once more seeming to control the circulation of their contents. Always provided, however, the escape from the vessels, and the yielding of the surrounding texture, to receive what has escaped, advance consentaneously, and in harmony.

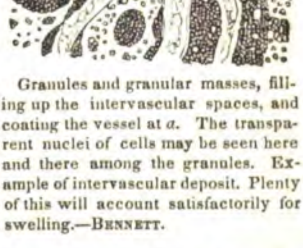
Fig. 10.



Example of swelling in submucous tissue, producing a fatal result by occluding the glottis. Acute œdema glottidis; exposed from behind.

Of this favorable kind are very many of the swellings in an inflaming part, with which the surgeon has to deal; as in erysipelas, phlegmon, fractures, bruises, &c. It is, therefore, an error invariably to regard the amount of swelling as a certain index to the extent of mischief; nor ought even great tumescence to warrant, of itself, a gloomy prognosis. Further, swelling is not to be invariably prevented, or opposed in its progress; on the contrary, it is often to be invited to the part, and, when there, promoted in its advancement; exudation being likely to relieve the laboring vessels. Besides, we have seen that the most prominent change effected in the blood by the inflammatory process, is increase of the proportion of fibrin, and this may be regarded as the principal inflammatory ingredient in that fluid. If much of it be extruded from the vessels, either *per se* or along with the serum, it were most reasonable to expect benefit from such an event. And thus we may obtain another reason in favor of swelling as a salutary occurrence.

Fig. 11.



Granules and granular masses, filling up the intervascular spaces, and coating the vessel at *a*. The transparent nuclei of cells may be seen here and there among the granules. Example of intervascular deposit. Plenty of this will account satisfactorily for swelling.—BENNETT.

The exudation of plastic fibrin will afterwards be seen to be further advantageous, as constituting a most important limit to the central suppuration, when that occurs.

From what has been said, it is already apparent how the tendency of swelling is prominently connected with the texture of the part; the less yielding, the less favorably disposed for exudation. The process advancing, so does the escape of the vascular contents; but should the texture refuse to accommodate this growing addition to its bulk, there arises, as it were, a struggle between the unloading vessels and the unyielding part, the issue of which is sure to be disastrous. It is the surgeon's office to watch this, and to either maintain or restore harmony, if possible. Otherwise, pressure from the pent-up exudation reacts disadvantageously on the bloodvessels and nerves of the part; tension is soon accompanied by throbbing, heat, and violent pain; the morbid process has received a fresh impulse, and advances accordingly. Or the tightness of pressure thus caused may be so great, as to arrest altogether the circulation in the part, already inclined to stagnation; so rendering gangrene inevitable.

Hence it is that rapid swelling in a loose texture tends always to relief, as in the ordinary areolar tissue; while swelling in that which is unyielding requires both constant and skilful care, and even then does injury. Acute exudati[illegible]h a tightly spread fascia, or between bone and its [illegible] are occurrences invariably severe, and prone to r[illegible] of texture. Acute disease, with rapid exudation i[illegible]clerotic conjunctiva, is comparatively harmless; while, in the corn[illegible]e result may be gangrene.

3. *Heat.*—This is a symptom sel[illegible]nt, or devoid of prominence. And it is easy to imagine how it [illegible] so, when we remember that the source of animal heat is proba[illegible] found in the changes effected in the blood of the capillaries; cha[illegible]ch, during the inflammatory process, are evidently carried on [illegible]eater rapidity and energy, though in a perverted manner. I[illegible]s cause, the temperature is necessarily elevated somewhat above its former and ordinary range; as is apparent to the touch. But nerves of sensation, partaking in the general disorder of the part, have in consequence their functions excited and perverted. In truth, increased sensibility is one of the signs of the inflammatory process. And when with that we couple the circumstance of an unusual amount of changing blood giving an actual elevation of temperature, we can readily understand how the patient should feel a greater heat than the thermometer would indicate. The heat of inflammation, therefore, is partly actual, as ascertained by the touch or thermometer;[1] partly the result of perverted nervous function, estimated only by the patient.

The inflammatory heat, like the redness which is so closely connected with it, is seldom very transitory; and this is an important characteristic mark. Blushing brings heat as well as color; but both are evanescent.

Heat must also be conjoined with other symptoms of the perverted condition. In hectic, there is often a constant burning in the hands and feet; yet no inflammation is there.

4. *Pain.*—Of all the symptoms of the inflammatory process, this is probably the most characteristic. Yet pain is not unlikely to deceive.

Nerves of sensation, in the part inflaming, have, as already stated, their function excited and perverted; they are compressed by the distended vessels, more especially when lodged in the same fibrous sheath; and such pressure is most materially increased by the advancing exudation, particularly if this be situated in an unyielding texture. Besides, at each throbbing impulse of the blood, the arterial vessels, themselves altered in their coats, undergo not only dilatation but elongation; from this the nervi vasorum must more or less suffer, and they contribute something to the general amount of pain. That pressure is somewhat concerned in producing the pain, may be inferred from the fact, that this symptom is invariably aggravated, and chiefly felt, when compression of the part inflamed is increased—as by the hand in peritonitis, or by inspiration in pleurisy. Over and above this, however, there is pain in inflammation which cannot be accounted for on any mechanical theory. The presence of pain in erysipelas, and its absence in anasarca; its presence in peritonitis, and its absence in ascites—under the same, or nearly the same, mechanical conditions—show clearly that the morbid inflammatory sensation must be regarded as in great part developed according to a peculiar law.

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[1] The natural temperature of the body varies from 98° to 100°, at the heart and on the trunk, and is about 92° at the extremities. In parts inflamed, the thermometer has indicated a rise to 101°, 104°, 105°, and even 107°, of Fahrenheit.—(Article INFLAMMATION, *Cyclopædia of Practical Medicine*, p. 738.)

Such causes are liable to vary, and so is their result. Inflammatory pain is not uniform, but influenced by the intensity of the action and the nature of the part affected. The higher and more rapid the action, *cæteris paribus*, the greater the pain. Inflammatory change in a part originally sensitive produces much more pain than in one naturally dull —even although under a less amount of disease; an erysipelas limited to the true skin, and tending only to serous effusion, is far more painful than suppuration of the subcutaneous areolar tissue. As formerly stated, pain is also modified according to the power of yielding in the part, to accommodate exudation; inflammation of bone is more painful than inflammation of skin; erysipelas is more painful than inflammation of mucous membrane; inflammation of serous and fibrous tissues is more painful than either.

Pain is not always inflammatory; it may be the attendant on spasm, or on simple irritation. The pain of spasm is intensely violent from the very outset; and, though often abating more or less during its stay, seldom advances to a higher degree than that with which it began. The pain of inflammation, on the contrary, usually commences with a slight amount, and steadily advances; hourly increasing, until either the disease is subdued or the part has perished by gangrene. Pain of spasm is often relieved by pressure; at all events, is not aggravated thereby. In inflammation, pressure, even slight, is quite intolerable. In colic, a grateful sensation may be caused by placing weight upon the belly, while in peritonitis the slightest touch is torture.

In neuralgia—an example of Irritation—pain is severe at its first onset, like that of spasm; it remits much and variously during its course; and often intermits wholly, during intervals more or less prolonged. The pain of inflammation may remit, but only slightly; and is never intermittent. It may disappear suddenly; but if so, is not likely to return —the part having, in all probability, ceased to be amenable to further vital change.

The characteristics of inflammatory pain, then, are—It usually commences in a comparatively slight form, and steadily increases; it is constant, until either the disease resolve or the part die; and it is invariably aggravated by pressure.

Sudden disappearance of inflammatory pain always excites suspicion.

It is inconsistent with its ordinary character; which is, to grow steadily as the disease advances, and to subside as this recedes. In neuralgia, excruciating agony often ceases in an instant, for some hours is wholly absent, and then probably returns as violent as before. Such is its ordinary character and tendency. But it is not so with inflammatory pain. On its abrupt cessation, we do not dream of a mere remission of its cause; but suspect, and too often with truth, that the part is no longer capable of sensation, and has lapsed into gangrene. For example, a portion of bowel is acutely inflamed, connected with hernial protrusion or not; the pain is excruciating; on a sudden it ceases, and the patient gratefully expresses his relief, and thinks he is better, perhaps safe; the surgeon, on th[illegible]ned, and looks to the pulse, the surface, and the face [illegible]ble, cold and clammy, and collapsed; the part has [illegible]

In inflammation, pain [illegible], or as it were, *latent*. An acute abscess may have [illegible]eviously paralytic, deprived of sensation as well as motion; and [illegible]tient's attention may have been scarcely attracted to the part, [illegible]erception of aught unusual. Or injury of a limb has been accor[illegible] with affection of the brain, inducing coma, perhaps long conti[illegible]n the limb inflammation may be advancing destructively, yet pain [illegible]ither felt nor evinced by the sufferer. In such cases, the surgeo[illegible] feel for his patient; and, in the absence of pain, he should be un[illegible]attentive to the other symptoms of local disorder.

Pain sometimes may be termed *sympathetic*; referred to a part at a distance from that in which the inflammation resides. Such a part is either connected intimately, by function, with the other; or it contains the terminal expansion of nerves, whose trunks pass through or near the inflammation. Thus we may have suppuration in the hip-joint, causing infinitely less pain in that articulation than in the region of the knee; abscess of the liver producing pain in the shoulder; inflammation of the pelvis of the kidney causing pain at the orifice of the urethra. It is of the utmost importance that the practitioner bear this in remembrance; otherwise he may be leeching the knee, instead of the hip; rubbing the shoulder, instead of attacking the liver; looking for the outbreak of a gonorrhœa, instead of opposing a renal malady which is soon to bring life into imminent peril.

Pain is of itself a formidable thing: if intense and constant, certain to exhaust the powers of life; and, in consequence, in many inflammations it must be overcome at whatever cost. Also, when the part inflamed is an internal organ, intimately connected with the ganglionic system of nerves, the pain is of a peculiarly depressing nature, and highly dangerous by continuance. But, ordinarily, the attendance of pain on inflammation may be viewed rather as of a salutary tendency. Were the action painless, practitioner and patient might be unaware either of its existence or of its extent, until too late to save texture, function, or even life.

When inflammation is the result of direct application of an exciting cause, as wound, heat, or acrid substance, pain usually precedes the vascular disorder; an immediate effect on the nerves of sensation. This may continue, more or less, and become merged in the inflammatory pain; or it may soon cease, leaving the greater portion of the period of incubation comparatively free. Such pain is also not without its use, leading to precautionary and preventive measures—often more valuable than the curative.

5. *Throbbing.*—This seems to be the result of obstructed circulation in the part; and does not occur, at least to any extent, until the process has reached the period of sanguineous stagnation. Expose the femoral artery, and its play seems even and gentle; but place a ligature around it, and on the instant the blood beats tumultuously on the cardiac aspect, as if angrily laboring to overcome the obstructing cause. The inflammatory process begun, the arterial trunks in the neighborhood seem to act with unwonted energy in bringing down the increased supply, as yet free in its course; this may be felt by the observer, and also by the patient, but is often unappreciated by the latter; and the sensation of throbbing is then either absent or slight. But when, with an increased supply, there is also obstruction to its direct transmission, a threefold energy seems to be demanded of the arteries; in bringing an unusual load, propelling it by a circuitous route, and struggling against the obstruction which lies directly in the way. Such effort is felt by the patient, and that distinctly. Throbbing is thus readily accounted for in the part, and in the arterial trunks leading to it; the amount varying according to the degree of obstruction, and the intensity of the disease which has produced it; also modified by the texture of the part affected.

Experience teaches that when there is much throbbing attendant on the inflammatory process, suppuration is likely to ensue. It is easy to imagine how this should be the case; in a part with its direct circulation much depressed, and its collateral current much increased, with exudation copious, and extravasation by lesion imminent. Throbbing and a tendency to suppuration depend on the same cause.

Throbbing is painful; at each pulse the patient's sufferings are increased. It is then that the nerves, already tightened in their place by the circumjacent exudation, are most severely compressed; and it is then that the vascular coats, themselves disordered, are stretched as well as dilated.

6. *Disorder of Functional Sensibility.*—This is the result of perverted nervous function. The eye, when sound bears a flood of light with impunity; inflaming, it winces under the faintest ray shot directly upon it. The skin, in its healthy state, bears much manipulation; in erysipelas, the slightest touch is resented. The stomach in health neither rejects food, nor does sensation of discomfort indicate the presence of food; yet the same organ, becoming inflamed, is intolerant of the simplest ingesta. The bladder ordinarily awaits its full distension by urine; in cystitis, the smallest accumulation is expelled with urgency.

Obviously, this is also a wise and beneficial arrangement. Rest, as we shall see, is one of the most important means whereby inflammation may be met and subdued; and intolerance of function is of use, not only to suggest the propriety of rest, but also to compel its adoption. How lamentably destructive might not inflammation prove, were it unaccompanied by pain and increased sensibility!

7. *Disorder of Functional Activity* invariably attends, more or less, on the inflammatory process; the degree of disorder usually keeping pace with the progress of the disease. From the beginning, function is depressed; and probably is ultimately arrested, in that part where the true inflammatory crisis has been attained—the blood stagnating, and structural change fairly established. On subsidence of the inflammation, function is resumed; but when resumed, it is for some time more perverted than previous to its arrest; and slowly if ever returns to its pristine and normal character.

The stomach, inflaming, fails in its duty as a digestive organ; the kidney, as an uropoietic; the bladder, as a receptacle of urine; the brain, as an organ of s muscle or bone as an organ of locomotion; an arte an of circulation; an eye or ear, as an organ of spe

In secreting membr ntly an abnormal activity of function in the beginning y process; but this is truly a perversion rather than an increase on. For example, in gonorrhœa, the ordinary mucous secretio st augmented, probably in a diluted form, containing an unus nt of serum; then it grows less copious and more glutinous, t r sanguinis contributing more to its formation; by and by it cha ll more, and has a puriform or milky appearance; and soon it is her arrested, the dry mucous lips then bearing more redness, swelling, pain, and heat than before. But true acute inflammation cannot long persist without inducing either ulceration or gangrene; the disease gradually declines, and the part is moist again; at first, perhaps, blood escapes, or this may happen previous to declension; then comes suppuration, real or apparent; then the glutinous and the serous fluids once more; and ultimately the settling down to the ordinary mucous secretion. Or malapraxis may carry the illustration a step further, by repetition. At an early period of the disease, while matter is flowing in profusion from the orifice, an intensely strong injection is applied—not of the nitrate of silver; the discharge is speedily arrested; but the disease is not cured; for the ordinary signs of inflammation are aggravated, and the discharge reappears more copious and inveterate than before. The disease had begun to decline; but the ill-advised remedy, acting as a fresh exciting cause, brought back the true inflammatory crisis.

Extension of the Inflammatory Process.

The inflammatory process may extend, 1. *By Continuity* of the inflaming texture; and certain textures are peculiarly prone to such extension—as the skin and mucous membrane. It is no uncommon thing to find an inflammation of skin, the result of injury, and at first a mere pustule, spreading continuously into an erysipelas. And perverted vascular change, at first limited to one portion of mucous membrane, often quickly spreads over a large space of the same tissue; from the fauces to the larynx, trachea, bronchi, and bronchiæ; from the pharynx to the œsophagus; from the stomach to the bowels; from the vagina to the urethra; from the urethra to the bladder.

2. By *Continuity;* the texture successively involved not being continuous, but connected by juxtaposition; and usually, the more loose the intervening texture, the greater the facility of extension. In neglected phlegmonous erysipelas, the disease commencing in the surface may soon reach bone and joint; inflammation in a mucous membrane often induces abscess on its exterior, as in the case of the urethra; originating in the envelope of an organ, it may pervade the organ itself.

The more rapid the attainment to the true inflammatory crisis in the part first attacked, the more likely is the disease to extend, and that quickly, to those in the neighborhood; for its advance is unopposed by attendant change of structure. In the formation of an ordinary acute abscess, the progress is gradual; and the central portion truly inflamed is surrounded not only by serous effusion, but by a mass of dense fibrinous deposit, filling up, and as it were fortifying the previously loose tissue, and exerting a restraining influence on both the extension of the disease and the diffusion of its products. In phlegmonous erysipelas, on the contrary, the crisis is much more speedily attained, there is no such salutary barrier, the surrounding texture remains open both to extension of inflammation and to diffuse infiltration of matter. The consequent mischief is great and often irreparable. The limiting fibrin is either not deposited; or, as more frequently is the case, the exudation is of an aplastic kind.

Many other examples might be given of the advantage derived from true inflammation being preceded by active congestion; suppuration being surrounded and limited by plastic fibrinous deposit. Often the texture and efficiency of an internal organ are thus saved; often an irruption of pus into an internal cavity is prevented, which otherwise would have endangered life, either by compression of some neighboring part, or by violent inflammation of the cavity's lining membrane.

3. Extension of the inflammatory process may be *Remote*—that is, the part secondarily involved is at a distance from the original site of disease; and the intervening parts are unaffected. This may be effected by 1. *The Blood.* This fluid, as formerly seen, emerges from the inflaming part, changed, as from a laboratory; and circulating thus altered to other and distant parts, may itself become the exciting cause of perverted vascular function there. Purulent formations—in fact, unusually rapid and acute abscesses—occurring in certain forms of phlebitis, at a distance from the affected vein, may be thus satisfactorily accounted for. 2. By the agency of *Absorption.* A part is inoculated by a hurtful virus, and inflammation results in the wound; besides, a portion of the virus has been carried on by absorption, not only contaminating the system, and so establishing constitutional disorder, but also lighting fresh fires in its inward track—it may be while the conducting apparatus is almost or altogether unscathed. Thus a poisoned wound of the finger causes first superficial paronychia, and then glandular abscess of the axilla, often without apparent affection of the intervening lymphatics. When they suffer, the case is plainly an example of continuous as well as of remote extension. 3. By *Nervous agency.* By this, sympathy of function is maintained between distant parts in health; by the same agency, sympathy of disorder may be established in disease.

Thus, morbidly as well as ordinarily, the uterus is found sympathizing with the mamma; the testicle with the urethra; the kidney with the bladder.

Appearances of the Blood.

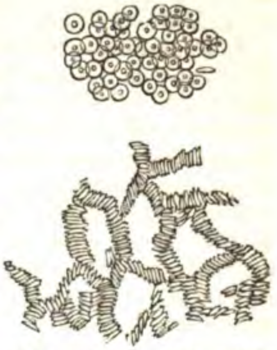
But the disease extends not only from one part to another; it also spreads from a part to the system. It seems not unreasonable to suppose that the local irritation which produces the increased vascular excitement, may be extended through the nervous system to the centre of the circulation: so producing constitutional disturbance, or inflammatory fever (p. 37).

But besides, the blo[illegible]lergoes serious change in the inflaming part; and by [illegible]n of such changes, the whole fluid comes at length [illegible] to the same extent as that portion of it which ha[illegible]he seat of local disease. In a case of decided and [illegible]on, draw blood directly from the part, as well as at a great dist[illegible]n it; and the two fluids will be found exhibiting nearly the sam[illegible]ers of change. Coagulation is slow, and results in a clot un[illegible]nse; surrounded by serum, which is apparently increased in [illegible], because thoroughly squeezed out of the solid matter. In the c[illegible] fibrin and colorless "lymph globules," go together; separating [illegible]e red corpuscles, which are probably diminished in number, but have [illegible]so their tendency to cohesion augmented. The red corpuscles occupy the lower plane, by reason of their greater specific gravity; the fibrin and colorless corpuscles keep the surface, which accordingly becomes of a yellowish hue; and to such blood the term "buffed" is ordinarily applied. But the increased aggregation in the fibrin not only leads to separation from the red corpuscles; it causes contraction of the buffy or fibrinous layer. The contraction being centripetal, the circumference of that layer leaves gradually the sides of the recipient vessel; the weight of the general clot at the same time drags on the centre, occasioning a hollowing of the fibrinous surface; and the blood is said, in consequence, to be both "buffed and cupped." The coagulum is usually of the form of an oval, truncated at both extremities; with its base broader than the top, and often adherent to the bottom of the vessel. When slightly buffed, the clot is usually cylindrical, and floating.

Such are the appearances of inflammatory blood drawn in mass. If it be taken in a full stream, into a deep vessel, exposed to warmth, these appearances are favored: a tiny trickling stream, a shallow vessel, and exposure to cold, are, on the contrary, unfavorable to their occurrence. Also, at different times of bleeding, and even of the same bleeding, such characteristics may vary; the portion first drawn may be neither buffed nor cupped, while that which flows last is both, and intensely so. When the blood is but slightly changed, it is said to be *Sizy*.

These characters appear to result from an increased tendency to aggregation of the blood corpuscles, which are seen by the microscope to collect themselves into rolls; clinging together with great tenacity, and imparting in consequence a granular appearance to a thin layer, even when viewed by the naked eye. It is probable that subsidence of the globules in inflammatory blood, so as to form the buffy coat, is much promoted by this change in the mode of their arrangements; as well as by the slow coagulation already adverted to.

Fig. 12.



Microscopic diagram showing the reticulated arrangement of the corpuscles in inflammatory blood. In the upper part, normal ordinary aggregation is shown in contrast.—WHARTON JONES. Edinburgh Medical and Surgical Journal, October, 1843, p. 309.

The appreciation of these characters by the unaided eye, in a thin layer—as on the point of the lancet, or on a plate—is very important in practice. We may be very anxious to know whether blood will present the inflammatory characters or not; and yet the case may be one of such doubt and difficulty, as to make us very unwilling to encounter the risk of taking away blood in any considerable quantity unnecessarily. Such risk need not be run; a drop suffices.

But it must ever be remembered that the buffed appearance is not, of itself, a sure indication of inflammation. It may be seen in blood drawn from chlorotic,[1] as well as from pregnant females; from patients affected by sanguineous plethora, or from any one whose circulation has been much accelerated, as by violent exercise; and, in the horse, it is the ordinary state of the blood. On the other hand, we know that an active and most serious inflammation may be present, while in the blood the ordinary inflammatory characters can be but faintly traced. These are but the exceptions, however; yet exceptions all-important to the practitioner; inasmuch as, while the presence of the buffy coat alone will not warrant him in reckless expenditure of blood, neither will its absence, during urgency of other symptoms of inflammation, be a sufficient excuse for withholding the lancet.

Again:—both the buffed and cupped appearances vary according to the texture involved. Perverted vascular function in the fibrous tissue, as in rheumatism, invariably presents a high degree of change (p. 61); while a much more formidable disorder may be advancing in the parenchyma of an internal organ, the change of whose blood is comparatively trivial. The inflammatory process affecting a serous membrane gives much of the buffy coat; less will come from a higher amount of disease in a mucous expansion.

In consequence of inflammation, then, we have an unusually active circulation of a deteriorated fluid throughout the system; and it need not surprise us to find the important vital organs impaired in function accordingly. All are more or less disordered; and the state of *Fever* is established (p. 37).

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[1] Arrangement of fibrin to constitute the buffy coat, does not depend so much on actual increase of the fibrin, as on its proportional excess over the red corpuscles. In chlorosis the latter are very much diminished in quantity, while fibrin may be tolerably abundant.

The simply febrile condition is not capable of establishing such proportional excess of fibrin; a local inflammation must be present. That is the laboratory whence the change issues; without it, as in ordinary fever, fibrin is deficient both actually and relatively.

Causes of the Inflammatory Process.

These have been divided into, 1. Predisposing; 2. Exciting; 3. Proximate. But as the last is really the thing itself—the phenomena of the disease, already considered—we have to do only with the two first.

I. *Predisposing Causes.*—These may act through the general system, or directly on the part itself, or in both ways. 1. *Unwonted excitability* may reside in a part or in the system, by exaltation of the nervous function. When occurring locally, it manifestly predisposes to the inflammatory process, whose first movement is an impression made on the nerves by the exciting cause. By strained use, for instance, the eye has its sensibility exal on of ophthalmia is favored. 2. *Plethora* may be ge former—either the result of original temperament, as by excess in diet—may, by the abundance of plies, favor increased flow of this to any particular pa the induction of inflammatory change. But it is probable oes not act so often, or so much, in this manner, as is gener ed. The blood itself is not predisposed; its red globules are i ot the fibrin. There can be no doubt, however, that local ple at is, determination of blood to a part—however induced and that strongly, to the inflammatory process; whose t, after the nervous impression, is this very sanguineous determin . Increased and sustained use of a part—as of the eye, kidney, liver—both heightens its sensibility, and brings to it a determination of blood; and thus doubly predisposes to inflammation. It is familiar to all how every organ thus exercised is prone to be inflamed.

It may be further observed, that local plethora, with the disposition to perverted vascular function which it engenders, has an important relation to age. In infancy and childhood, the brain is peculiarly liable to suffer; in adolescence, towards puberty, the pulmonary organs; in the adult, the abdomen.

3. *Debility*, general and local. This is by far the most prolific class of predisposing causes. A vital *power* or strength resides inherently in the system, and in parts of that system, whereby morbid change resulting from the application of an exciting cause, is either resisted successfully and averted, or, when commenced, is controlled and modified. The greater the impairment of this vital power, the more prone are system and part to the occurrence of disease. Inflammatory disease thus often predisposes indirectly to inflammatory disease. A part inflamed, we formerly saw, has its vital power impaired, and never wholly recovers in this respect; it remains weak, and consequently predisposed to recurrence of the disease; sure to be overcome by even a slight exciting cause, whose stimulus it could previously have borne with impunity. Bad food, air, and clothing; intemperance; excessive and habitual exertion of mind or body; excessive and habitual evacuations; previous disease, and often the treatment necessary for its removal—are other familiar examples of causes of debility, and consequently of predisposition to inflammation.

Predisposing causes may be combined. An eye, for instance, may have a determination of blood towards it, at the same time that its sensibility has been exalted by unwonted exercise of function; by a previous inflammation, the part is weak; and by confinement, bad air or food, sustained mental exercise, or all together, the frame also is debilitated. A part thus unfortunately situated can scarcely avoid becoming seriously inflamed, under the influence of renewed excitement.

II. *Exciting Causes.*—Those which directly induce the morbid process. The more prominent may be shortly mentioned in detail. 1. *Ordinary Irritants;* as acids, alkalies, many salts, alcohol, turpentine; acting by direct stimulus, on both nervous and vascular systems of the part. 2. *Wounds*, and other mechanical injuries, require a certain amount of active congestion for their cure; not unfrequently that process is by circumstances carried beyond what is simply salutary, and prolonged into true inflammation; suppuration is established; and healing is delayed, until the process shall have again subsided from the inflammatory acme. 3. *Lodgment of foreign bodies.* A wound, under any circumstances, is not unlikely to inflame; and if it contain extraneous matter, which is not removed, inflammation is inevitable—the result of prolonged application of stimulus. 4. *Pressure*, in like manner, is a prolonged stimulus; if slight, the absorbent system may be chiefly excited, causing simple absorption; if severe as well as sustained, the nervous and vascular systems suffer also; inflammation is produced, and may cause ulceration or even gangrene. 5. *Heat* is a most powerful agent. Extreme, it may at once reduce the part to the condition of a dead eschar; applied more leniently, it proves a stimulus to both nerves and bloodvessels, inducing perverted function of the latter, which may vary from simple excitement to the most intense inflammation. 6. *Cold*, considerable and sustained, may act as an excitant of inflammation, either on the part itself, whose temperature is diminished, or on some other part at a distance. (1.) At a distance. Cold is applied to the feet and legs, or to a large part of the general surface. Circulation is enfeebled there, as shown by the pale and shrunken integument. The blood, instead of being equally distributed over the body, is pent up within, and overloads the internal organs; one of these—the lungs, for example—is more burdened, or more susceptible than the others; it has obtained the first vascular move for the inflammatory process; that process is begun and advances. (2.) On the part itself; not by the first effect of cold, but by reaction following upon this. While decrease of temperature is maintained in the part, comparatively little blood circulates therein, its nervous influence is depressed, and all vital power, as well as action, is enfeebled. On withdrawal of the cold's influence, blood rushes back to the comparatively empty capillaries; nervous agency is restored, with a tingling; simple vascular excitement, or in other words, the first stage towards inflammation, is at once established, and that in a part whose vital power has just before been impaired, and which, consequently, is but little able to resist or control the change so commenced; this advances comparatively unopposed, and the part may fall an easy prey to inflammation. The onset of inflammation will of course be more rapid and severe, if the cold be not merely removed, but heat, friction, or other stimuli, at the same time applied. Nothing can be more injudicious, yet there are few practices more common; grave inflammation is rendered inevitable. 7. *Atmospheric change* may prove either predisposing or exciting; the former, when exposure is general and habitual, usually associated with habits of intemperance; the latter, when exposure is partial and sudden. It is familiar to all how often inflaming throats, eyes, lungs, and joints, are attributable to casual exposure to atmospheric vicissitude. The *modus operandi* is similar to what has just been explained in regard to cold. 8. *Undue exercise of function*, in like manner, may either predispose or excite; according as it is habitual, or casual and excessive. It operates by inducing local plethora, at the same time exalting sensibility; not only inviting the change, but giving the first move in its advance. 9. *Vitiated secretion* acts as a direct communicator of irritation; (1.) From one part to another, in the same patient, as tears to the cheek; or discharge from the rectum and vagina, to the cleft of the nates. (2.) From one patient to another; as gonorrhœal discharge, from the urethra, acting on the conjunctiva, or on the genital organs. (3.) From the lower animals to man; as in the case of the vaccine virus, and glanders. 10. *Retention of the ordinary secretion* of an organ tends to inflammation; retention of urine may be followed by cystitis; distension of the lachrymal sac, by fistula lachrymalis. Secretion, when healthy, is no stimulus to the part; but, when changed in quantity, quality, or in both, it may become so.

The inflammatory process may occur without any apparent or assignable exciting cause. It is then said to be spontaneous or *idiopathic*.

Duration and Character of the Inflammatory Process.

Generally speaking, rapidity of progress and intensity of disease are phrases nearly synonymous. Sometimes the process is very gradual in its advancement; requiring, as in the example of the vaccine pustule, formerly adduced (p. 100), eight or nine days for its completion; and many inflammations are yet more protracted. After a wound, or other mechanical injury, the process is usually complete, and suppuration established, by the second or third day. One day, or less suffices for the occurrence of suppuration in many cases of phlegmonous erysipelas. And the secondary abscesses attendant on phlebitis, there is every reason to believe, are begun and completed within a very few hours.

Progress varies, as to time and character, according to—1. The *Structure* of the part affected. The more highly organized, vascular, and endowed with nervous energy, the more rapid and intense the inflammation—*cæteris paribus*. 2. *Situation* of the part. The nearer to the centre of circulation, the more disposed to rapid and severe disease. 3. *State* of the part. When vital power has been impaired, by previous disease or other debilitating cause, the part is prone to undergo inflammatory changes; and these invariably tend to a speedy and unfavorable issue. All adventitious structures, also, being of low organization and vitally weak, soon yield before the inflammatory process. 4. *Temperament* of the patient. The sanguine temperament favors both rapidity and intensity; in the nervous, disease is readily induced, but is prone to assume the mild and chronic form; the phlegmatic is unfavorable to occurrence, rapidity, and intensity. 5. *Diathesis* plainly modifies inflammation, both in its occurrence and character; as is exemplified in the scrofulous and rheumatic affections (pp. 50 and 61). 6. *Age.* In childhood and infancy, inflammation is both likely and acute; often its progress is fatally rapid. In adolescence, its general character is also acute; easily induced; but not so apt to end disastrously, there being usually enough of vital power to maintain control. Then too, by reason of habitual activity in the nutritive function, the inflammatory process is usually attended by copious exudation of the more solid kind; either fibrinous or albuminous—plasma or tubercle—according to the power and disposition of the system. In adult life, disease is probably less easily induced, but is generally acute, and is apt to prove formidable by intensity. Old age is more prone to passive congestion; and when the inflammatory process does occur, it is commonly languid, slow, and tends to an unfavorable result; for, both part and system are lowered in vital power. 7. As regards *Sex;* Females are constitutionally prone to inflammatory affections; but males are more exposed to casual predisposing and exciting causes; the latter sex too, may be considered as pre-eminently liable to disease of an acute and sthenic type. 8. *Habits* of intemperance predispose to inflammation; rapid, and acute, but often asthenic, and apt to end injuriously. Sedentary habits are also favorable to accession; but usually the disease is more under control. Privation—involuntary or assumed—is unfavorable to accession; and inflammation is usually chronic or asthenic. 9. *Atmosphere and Season* are related to inflammatory disease, not only as important predisposing causes, but also as materially influencing its progress and type. An evil atmosphere impairs the vital power, and so favors the onward progress of morbid change to a rapid and unfavorable issue. In like manner, an unhealthy season fully vindicates its title to the name, by its subtle and sinister influence on inflammatory as well as on other forms of disease; as the history of erysipelas, especially when epidemic, abundantly testifies.

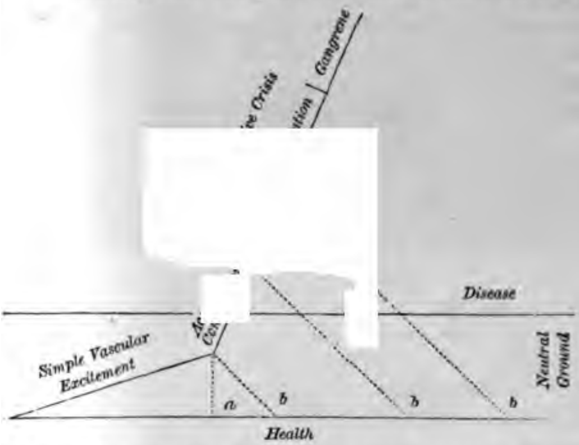
RESULTS OF THE INFLAMMATORY PROCESS.

I.—*Resolution.*

This is the most favorable result, and that to which treatment is usually directed. But let it never be forgotten, that such treatment must be early as well as suitable and active; inasmuch as this result can only be hoped for, while the process is yet beneath the inflammatory acme. That reached, true Resolution—that is, complete restoration of the part, as regards both structure and function, to its original and normal state—is impossible.

The accompanying diagram, though both rude and fanciful, may assist to make this more plain. It will also illustrate the opinion held as to the gradual formation of the true inflammatory crisis.

The commencement, not inconsistent with healthy structure and function; its consequences usually salutary; but sometimes, by persistence, injurious. The second stage, a departure from true health, and pressing on to true disease; the consequences sometimes salutary, in local emergencies—as in wounds and ulcers; but, in general, prone to evil by alteration of both structure and function. The third stage essentially morbid; utterly at variance with healthy structure and function. The higher results, which follow the crisis by continuance of the disease, are invariably subversive of function, and destructive of texture; and, consequently, are pernicious—unless when it has become essential, for the well-being of the whole, that the part so affected shall be removed.[1]



Resolution may be gradual or sudden, spontaneous or artificial, imperfect or complete; the more early and slight the morbid change, the more likely is the resolution to be rapid, spontaneous, and perfect.

When sudden, the term *Delitescence* is commonly employed; denoting an occurrence favorable in itself, but invariably associated, in the mind of the experienced practitioner, with a suspicious prognosis. Were the delitescence effected simply, and there an end, the immediate benefit derived would be without alloy. But experience tells us, that the abrupt and sudden disappearance of advancing inflammation in one part, is often, if not usually, followed by the appearance of similar disorder elsewhere. And, as we have no guarantee that the change shall be to an equally harmless locality, such change must at all times be a matter of suspicion, and often of danger. The disease, for example, may leave one part of the skin, and suddenly appear in another portion of the same tissue. Or it may quit an internal part, and show on the surface. In the one case, probably no harm is done; in the other, a decided advantage accrues from the change. But, on the other hand, delitescence of an erysipelas is often followed by establishment of the inflammatory process in a serous or mucous membrane, or even in the substance of an important internal organ; and such change may be—nay, often has been—fatal.

The process which effects subsidence of the original disease, and establishment of the new, is termed *Metastasis*.

Metastasis, however, may be only apparent. Often, disappearance of an external inflammation is quickly succeeded by the supervention of one that is internal; and the latter is rightly held related to the former, as effect to cause. Yet, not unfrequently, we may have the two circumstances contemporaneous or nearly so, with their relation reversed; the internal disorder proving the cause of the subsidence of the external—the less becoming merged in the greater malady.

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[1] The dotted lines denote the process of Resolution, or the return to health—*a*, sudden and direct Resolution, or Delitescence. *b*, *b*, *b*, lines of gradual Resolution from various points of the ascending process. The suppurative stage having been attained, true Resolution cannot occur.

Resolution being about to occur, increased deposit probably takes place, of serum, liquor sanguinis, or of both. By this means, among others, the burdened vessels are more or less relieved; they recover their wonted tone and calibre; and circulation revives from the impending or actual *remora*. The red corpuscles resume their individual distinctness; and the agglomerate masses, of both red and colorless corpuscles, first oscillate, and then move steadily on. The local determination of blood ceases; and the inflammatory changes begun in that fluid are recovered from. Absorption, which had been embarrassed hitherto, or altogether held in abeyance, comes actively into play; and the extravascular deposit (Fig. 12) is more or less rapidly removed—the more rapidly, the more serous its character. Ultimately, the balance of healthy nutrition in the part is restored, the deposit from the bloodvessels not exceeding the amount required to supply waste in the texture; and normal function is resumed.

Such change is marked by a corresponding alteration, equally favorable, in the local symptoms. The pain and heat are the first to subside; then the redness; ultimately the swelling more or less gradually disappears. Should the constitution have begun to sympathize, the fever will be found to decline—as formerly described (p. 42); and the absorbed exudation will be, at least in part, eliminated by the kidneys, and other glandular organs.

When the inflammatory process has been slow in its advance to the resolving point, as well as in its subsequent declension, resolution will probably be imperfect. Time has been afforded for the fibrinous deposit to assume a solid and organized form, and to become less amenable to absorption than when of fluid or semifluid consistence shortly after exudation. There is an obvious risk, consequently, of a certain change of structure either proving altogether permanent, or long resisting the efforts of absorption.[1]

Should the true inflammatory crisis have been closely approached, a certain loss of vital power will be permanent in the part, even after change of structure has been apparently altogether recovered from.

II.—*Excessive Deposit, by Exudation, through the Vascular Coats yet entire.*

This attends on advance of the process; and also persists, though to a diminished extent, during part of its decline. It may be serous, fibrinous, or both.

1. *Of Serum* containing more albumen, and of higher specific gravity

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[1] There is reason to believe that when fibrinous exudation has once become solid, it cannot be absorbed, "without the occurrence of changes in it, by which it is again rendered fluid. This is effected by the formation, ripening, and disintegration or decay (moulding) of nucleated cells, whereby the coagulated exudation is broken up, made soft, pultaceous, and diffluent."—BENNETT.

than in health. This, in combination with plastic exudation, attends the whole range of the inflammatory process; and is usually situate circumferentially. Occurring singly, it is the product of a low degree of the inflammatory process; and, as already stated, may be considered appropriate to the first stage.

It is seldom, however, that pure serum is found effused in connection with the inflammatory process; it almost always contains a greater or less admixture of fibrin. And this indeed constitutes a distinguishing mark between inflammatory serum, and that which is the product of congestion, or of mere dropsical effusion.

(*a.*) *Serum* may be effused in the *interior* of the part; occupying the fibro-areolar tissue, an [illegible] *Œdema.* The attendant symptoms are pain, he [illegible] portioned to the amount of disease; swelling vari [illegible] extent of effusion, and the nature of the recipient [illegible] unyielding, tension ensues, with increase of pain [illegible] the process onwards. But usually the surrounding [illegible] nmodating; the swelling is found soft when compare [illegible] th [illegible] ous character; and, yielding before the finger by temporary [illegible] t of the serum, the part is said to *pit* on pressure. The pi [illegible] ver, is much less distinct in the Acute than in the Chronic [illegible] e afterwards described.

(*b.*) The serous effusion may [illegible] *surface* of the part; whence it flows harmlessly away, like the or [illegible] ry secretion in health—as in the case of inflaming mucous membrane. Or it accumulates within an internal cavity, as in the case of the serous membranes; then constituting *Acute Dropsy* of the part; the bulk, uneasiness, and disturbance to healthy function by pressure, varying according to the extent and rapidity of effusion.

Fig. 13.

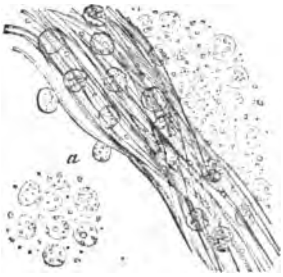

Fig. 14.

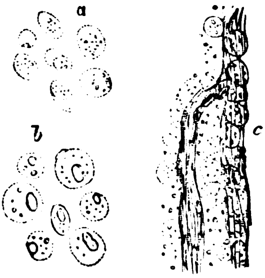

Fig. 13. Plastic corpuscles and filaments in recent lymph exuded on the pleura. *a*, The corpuscles unchanged by acetic acid. Fig. 14. Exudation from the surface of the peritoneum passing into pus. *a*, Isolated corpuscles; *b*, after the addition of acetic acid; *c*, plastic corpuscles and filaments.—Bennett.

Acute effusion of serum, whether in the form of œdema or dropsy, usually disappears soon after decline of the morbid process which produced it, by the resumed and increased play of absorption. Herein, again, practically most different from the result of Chronic Congestion.

2. *Of Plastic Fibrin.*—This may be exuded by itself, separate from the serum; but more commonly with the serum, in the form of liquor sanguinis, or coagulating lymph; the latter term denoting its peculiar

property of assuming the solid form by coagulation, when extravascular. It is the result of a higher degree of perverted function than the purely serous effusion; and, as formerly stated, may be regarded as the characteristic product of the second stage of the inflammatory process, Active Congestion.[1]

(*a.*) It may take place on the *surface* of the part; as on a serous membrane, or on the margins of a wound. On coagulation, the serous portion trickles away; the fibrin remaining, in the form either of a continuous film, or of masses more or less detached; at first transparent, afterwards becoming yellowish, and somewhat opaque. Should the disease at once subside, absorption finds the exudation quite amenable to its renewed play; and it is removed. But if the disease persist, and yet not have reached the inflammatory crisis, absorption does not take place, and an opportunity is given for organization of the deposit.

Fig. 15.

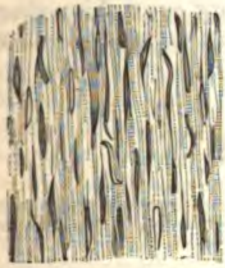

Fig. 16.

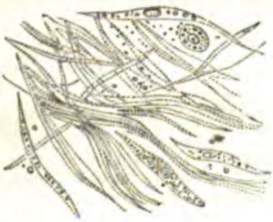

Fig. 17.

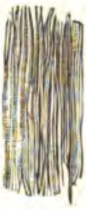

Fig. 15. Nuclei developing themselves into fibres. Fig. 16. Cells developing themselves into fibres. Fig. 17. Perfect fibrous tissue.—BENNETT.

Such deposits as are readily organized, are termed *plastic*. The exuded fibrin, when examined under the microscope, is usually found to possess two distinct elements. There is a filamentous basis, composed of very delicate threads, crossing one another in all directions; and apparently produced by a peculiar arrangement of the ultimate molecules, of which the fibrin is composed. These filaments enclose or entangle the second element, namely numerous cells, or corpuscles, of various sizes; some nucleated, others non-nucleated; and mostly containing a greater or less amount of granules, and molecules—probably composed of oily and albuminous matters, like the granules of an emulsion.

The fibrin, which in its recent condition presents these elements, may either be reabsorbed, or may become the basis of new tissue. In the former case, the coagulum is gradually softened, and dissolved; the cells either disappear, or burst and shrivel up; and the whole mass becomes full of "granules of disintegration" (*Bennett*), which are readily reabsorbed, in a fluid form, into the blood. When, on the other hand, tissue is formed, the cells or corpuscles assimilate new matter, become elongated and spindle-shaped; and, at last, assume the form and appearance of fibres, similar to those of areolar tissue.

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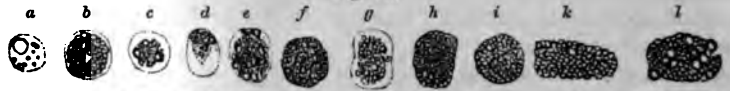
[1] Mr. Paget has made the remarkable and instructive observation that the quality of the effusion in the ordinary process of raising an artificial blister, is greatly modified by the state of the system, being highly plastic and fibrinous in strong constitutions, and corpuscular or sero-purulent in cachectic individuals.—See Lectures on Inflammation, Medical Gazette, 1850.

Another transformation which cells not unfrequently undergo, particularly in glandular organs, and in other positions where they do not readily pass into fibrous tissue, is into very granular corpuscles, and

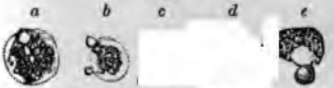
Fig. 18.



Compound granular corpuscles oftening. *a*, Nucleated cell with a few granules. *b*, Granules within the icleus. *c*, Granules over the nucleus. *d*, Granules within the cell, no nucl lled with granules. *f*, Cell completely filled with granules *g*, Cell contrac mpound granular masses, the cell-wall having dissolved. *k* and *l*, Compou from the vessels.—BENNETT.

masses composed of a great accumulation ' fatty or emulsion-granules within the cell-wall, or around the nucleu where there is no cell-wall;

Fig. 19.



Compound granular corpuscles acted upon by pressure. *a*, Some of the oily granules made to coalesce. *b*, Oil forced through the cell-wall. *c*, The same with collapse of the cell-wall. *d*, Rupture of the cell-wall. *e*, Dislocation of the nucleus.—BENNETT.

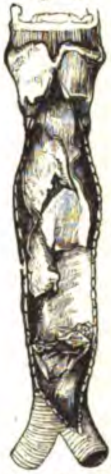
thus forming a body more or less dark, when viewed by transmitted light, and having a rough mulberry-like surface.

But, in order to insure permanence and perfection of structure, it is expedient that the deposit be supplied with blood and bloodvessels. Accordingly the process of Vascularization is commenced. Blood corpuscles are seen coursing each other through the plasma, in new bloodvessels; coming from, and again returning by, the vessels of the adjacent original structure. According to some, these new vessels are, as it were, self-formed in the plasma. Nucleated cells send out radiating processes, which elongate, communicate with each other, and finally abut upon the older and previous capillaries. These then unite with the newly-formed vessels; which dilate, and begin to receive blood corpuscles from the older ones; in turn transmitting the circulation to others formed in the same way in the lymph beyond them. Thus a canal is formed, continuous with original bloodvessels on either aspect; and circulation is established within it. Or, according to other physiologists, blood corpuscles escape, few in number, from the adjacent original vessels; and after oscillating in the plasma, push across and join the return veins. A new canal having been thus opened up, these first or "pioneer" corpuscles are succeeded by others in a continuous stream; insuring the patency of the canal, and establishing its circulation. And from such parent canal, or canals, divaricating tubes of a similar kind are channelled out by a similar process. Both theories may be true; new vessels may be formed, now in the one way, now in the other. To the practical surgeon, the question is of comparatively little moment. In whichever way formed, the new capillaries are at first composed of simple membrane. They may afterwards enlarge, and acquire fibrous tissue in their walls; being thus converted into arteries and veins.

It sometimes happens that the plasma undergoes a higher organization than that into areolar tissue, and is formed into texture similar to that in the neighborhood of which it was exuded—a process of change mainly attributable to transformation of the nucleated cells.

Be it remembered, that the process of organization is incapable of being carried on, so long as true inflammation exists; the tendency of inflammation being constantly and surely to the formation of *effete* matter, which is commonly thrown off in the form of pus.[1] The effete matter, however, is generally hemmed in and bounded by a margin of plastic fibrinous exudation, in which the inflammatory process has so far relaxed as to permit a certain degree of organization. This marginal new-formed tissue assumes, in many abscesses, the form of a limiting membrane; which is then called the "pyogenic membrane." Sometimes this membrane, or limiting tissue, is formed very imperfectly, if at all; and, in this case, the inflammation becomes "diffuse" in its character.

Fig. 20.



Example of false membrane, in croup. Its evil consequences very apparent.

Fibrin, more or less plastic, exuded on the free surface of a membrane, is usually termed *False membrane;* assuming a structural arrangement, in the first instance resembling that of the buffy coat of the blood, and ultimately forming a layer or coating somewhat similar to the original and invested tissue; when accompanied by purulent or seropurulent secretion, as it too frequently is—an attendant on true inflammation; but when either alone, or attended by effusion simply serous—the product of an amount of disease short of true inflammation. When of truly inflammatory connection, as indicated by the coexistence of purulent or seropurulent deposit, it is usually of low organization; and is to be regarded as analogous, not to the simple adhesion of a wound, but rather to the partially organized fibrinous exudation which precedes and limits the purulent secretion in an ordinary abscess.

(*b.*) Fibrin may be exuded in the *interior* of the part; and, being at first fluid, it insinuates itself so as to fill up every minute space; occasioning enlargement. Cohesion is, at the same time, generally impaired. If the disease be acute, the part is *soft* as well as swollen; a considerable proportion of the serum being mingled with the fibrin.

If the disease be slight and gradual, *Induration* is found instead of softening; the serum having been absorbed, besides in all probability having been sparingly effused at first; and the fibrin having leisurely assumed a higher and more permanent organization.

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[1] The opinion that a minor degree of the inflammatory process is most favorable to organization and vascularization, and more especially to vascularization, is strikingly corroborated by an excellent paper by Mr. J. Dalrymple—"On Rapid Organization of Lymph in Cachexia."—*Medico-Chir. Trans.*

If such disease continue in a chronic and subdued form, the deposit becomes fully organized and vascular. This being little amenable to absorption, a serious change is effected in the structure of the part; it is indurated, thickened, and enlarged; and should this morbid condition persist, causing continuance of plastic deposit in greater abundance than absorption can normally control, the enlargement and change of structure gradually increases; giving rise to the simplest form of tumor.

The inflammatory process ceasing, so does redundancy of deposit; absorption then busies itself in attempts to clear away what has been already heaped up; and in this good work it may often be materially assisted from without by the hand of the practitioner.

(*c.*) The exudation m *rface and in the interior;*
for instance, into the te rior of a serous membrane;
or on the surface of suc nto the parenchyma which
it invests. The result i he changes described in the
two preceding sections of

Thus we see that fibrin, exuded dur the inflammatory process,
undergoes various changes, according e grade of disease by which
it is accompanied. It may soften and sorbed; Resolution. Or it
remains and becomes organized; the inflammatory process having either ceased, or assumed a very subdued form. Or, the disease continuing, the plasma undergoes further changes; softens, and degenerates into pus.

During true inflammation, advance in organization ceases. On subsidence of the process to a minor grade, it may be resumed. But to all fibrin, organized under even the lightest degrees of inflammatory change, a general rule seems to be applicable, viz.; that it is of low or imperfect organization, and, by consequence, liable to destruction in one of two ways: either by simple decadence and absorption, on subsidence of all perverted vascular function; or by a secondary accession of such disease advancing to suppuration, softening and ulceration. This is favorable; as regards the discussion or disintegration of simple enlargements of inflammatory origin. Unfavorable, as regards reparation of solutions of continuity; and hence it is that the cicatrix by granulation—a process always preceded by true inflammation—is often undone, and the wound made gaping as before, while union either by adhesion or by the slow "modelling process," into whose composition true inflammation does not and cannot enter, remains comparatively firm and enduring.

It is only then, in the exudation of fibrin, not in its organization, that inflammation can bear a part; and that exudation is always the fittest for organization, which takes place under the slightest and most evanescent forms of the inflammatory process. By it wounds unite, bones knit, and arteries are consolidated. These salutary processes are wholly incompatible with the presence of true inflammation; and often are but ill performed after its subsidence.

Inflammation is essential—or indeed useful—towards reparation, only when the liquor sanguinis, by reason of debility, is deficient in fibrin; as in an old and indolent ulcer. An invariable effect of the inflammatory process, we know to be a marked augmentation of that plastic substance. Inflammation will bring an additional and probably sufficient amount of reparative material to the part, therein before defective; but such fibrin is not capable of due reparative application, until the morbid process which brought it has subsided from the true inflammatory crisis. Even then, as just stated, organization proceeds at a disadvantage. Still, organizable fibrin of the second class—that which is unconnected with true inflammation being of the first—is better than none at all.

III.—*Suppuration.*

The formation of pus is one of those results so closely and frequently connected with the inflammatory process—and usually with its higher grades—as to entitle us practically to consider it as one of the ordinary results of inflammation. In making this general statement, however, it must not be kept out of view, that suppuration is sometimes established with few of those concomitant signs which we have given as those of true inflammation; and certainly without a high degree either of the constitutional or of the local symptoms. In the granulation of wounds; in the slightest affections of mucous membranes; in the formation of what are called chronic abscesses, whether connected with disease of bone, or not; in many fistulas and sinuses; and even, though more rarely, in some diseases of the serous and synovial membranes—more especially if a stage of true inflammation have preceded—we may have pus formed without any true inflammatory symptom. Some of these exceptional cases, attended by more or less active congestion, are subservient to reparatory processes, and never pass the limits of salutary change; while others equally healthy in their object—as when a foreign body is extruded with and by discharge—are distinctly morbid in their phenomena. Although, therefore, true inflammation may not be considered absolutely essential to the formation of pus, it is nevertheless true that this process is present in all instances where suppuration is rapid and considerable.

Suppuration, originated by true inflammation, and maintained by a minor grade of the inflammatory process, may probably be arrested for a time by re-application of a stimulus which causes a fresh inflammatory crisis. For example, during the early stage of gonorrhœa, profuse purulent discharge having just begun, if a strong stimulant injection be employed, much pain is induced, and the part dries up. Again, however, it breaks out, with increased intensity, so soon as the second acme of inflammation has begun to give way; and in fact, this may be said to partially resolve itself by a renewed and increased discharge.

Pus is a yellowish-white, or greenish, opaque liquid; resembling cream, in consistence and general appearance; varying in specific gravity from 1030 to 1040; and with scarcely any peculiarity of odor, when pure and recent. It separates partially, on standing, into a clear fluid—very nearly identical, in its chemical and other properties, with the serum of the blood—and into a sediment, which is shown by microscopic examination to consist of peculiar corpuscles, usually with a greater or less quantity of finely molecular and granular matter. According to chemical examination, these corpuscles are composed, in great

part, of a protein compound; so that pus may probably be considered as an altered liquor sanguinis, in which the fibrin has assumed a molecular and corpuscular form.

Fig. 21.

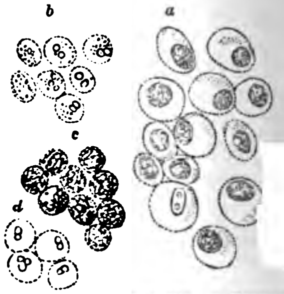

Fig. 22.

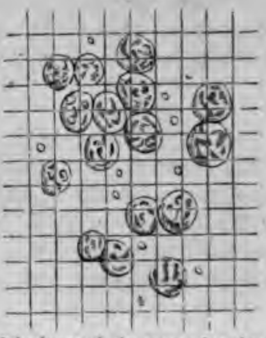

Fig. 21. Corpuscles in pus. *a*, Corpuscles in gray hepatiza of the lungs; *b*, the same after the addition of acetic acid; *c*, corpuscles in pus, from a subcutaneo abscess; *d*, the same, after the addition of acetic acid.—BENNETT.

Fig. 22. "The appearance of the pus globules and molecules is here shown upon a scale, the squares of which are $\frac{1}{1000}$ of an inch."—LISTON.

The corpuscles of pus are generally spherical, varying a good deal in size, but most frequently about $\frac{1}{2500}$ of an inch in diameter. They have much resemblance, in size and general appearance, to the white or colorless corpuscles of the blood; their cell-wall being somewhat opaque, but soluble to a great extent in dilute acids, which reveal a single, double, or treble nucleus.

In the partition of the nucleus, and in the comparative smallness of its size, pus corpuscles differ from the majority of cells found in fibrin which is undergoing organization; these latter being mostly either non-nucleated or single-nucleated, and the nuclei considerably larger than those of pus corpuscles (Fig. 20.) In plastic fibrin, also, the cells are in much smaller numbers than in pus; and the connecting filamentous element which exists in the former, is absent in the latter (Fig. 14.)

We are as yet imperfectly acquainted with the circumstances which determine the change of fibrin into the corpuscles of pus, instead of its simple coagulation, as in plastic exudation. But we know that suppuration is commonly, *cœteris paribus*, the result of a higher grade of inflammatory disease than fibrinous exudation, so that, as before explained, a deposit of pus, or abscess, is usually surrounded, and limited, by a circle of plastic exudation—the result of active congestion. But there are also special circumstances which favor the production of pus in particular cases. The free access of air to the part has a very marked influence; as is shown by the ready production of pus on mucous membranes, and on the surface of granulations. And the influence of a poultice, under certain circumstances, in favoring suppuration, appears to demonstrate the importance of heat and moisture to this process. In some states of the constitution, also, there seems to be established a tendency to the formation of pus; in virtue of which, all exudations assume exclusively this form. And frequently, in this state, suppuration takes place in many parts of the body at once; sometimes without any apparent connection with an ordinarily efficient local cause.

Pus is not a corrosive liquid, as the ancients imagined; but bland and protective. Tender granulations, for instance, are invested with it; for the express purpose of protection, and that effectually, until covered in by cuticular formation. It is true, that when "cribbed, cabin'd, and confined," in the interior of a part, it induces disintegration of those textures with which it is brought immediately in contact; not, however, by erosion, but by the pressure of its accumulation; such pressure inducing absorption, ulceration, or both.

Nor is its formation a chemical process, as at one time imagined; no melting down of the solids, by putrescence, as the name of *pus* (πυω) implies. It is essentially a vital action; quite as much so as the secretion of any other fluid, say the serous or mucous; only the one is the product of healthy, the other of morbid vascular function.

As the inflammatory process approached the completion of its third stage, we saw that there was increasing slowness of circulation of the blood, copious fibrinous exudation, extravasation of blood by giving way of the altered vascular coats, with consequent breaking up of normal texture; and that in the part so affected the formation of pus then speedily occurred, the pus displacing disintegrated original texture. In the formation of so large a number of cell-structures, imperfect in themselves, and not capable of further development, there is a complete perversion of all those vital processes by which nature carries on the work of organization; nutrition, secretion, absorption, and circulation, being all either suspended, or very much modified. At this point, therefore—the acme of the inflammatory process—destruction of the organizing power has been reached.

Pus, as we have described it, is of its normal character; and, as such, is usually termed healthy, or *laudable*. But various circumstances may cause deviation from this state. A chemical action—perhaps the result of atmospheric contact—may be superadded to the vital process; producing, by decomposition of the albumen of the serum, hydrosulphate of ammonia, whose presence is indicated by an offensive odor, and by the blackening of silver probes brought in contact with the pus. Putrescence might be thus begun in the fluid, while it is yet in contact with the living part.

Disintegration of the surrounding texture, by ulceration, is often coexistent with the formation of pus. It is then mixed with the fluid debris of the part; and, in consequence, becomes more prone to chemical change.

Or it may be mixed with blood, either fluid or solid. It is reddened thereby, and found to contain blood disks or masses of coagula. It is then termed *sanious* or *grumous*.

In those of weak systems, it is often deficient in solid matter, consisting chiefly of a thin serum; it is then termed *serous*. In the scrofulous and cachectic, besides being serous, it often contains flakes or masses of a curdy appearance; and to such pus the term *scrofulous* is usually applied.

Sometimes it is impregnated with a subtle virus, as the venereal; it is then said to be *specific*.

Or it may be variously mixed with secretions from mucous and serous membranes, and termed in consequence *seropurulent* and *mucopurulent.*

Several substances, met with in the organism, are apt to be confounded with pus. Fibrin which, within or without the bloodvessels, has been subjected for some time to the softening action of fluids; the creamy softening of cancerous growths; various fluids when intimately mixed, in certain proportions, with epithelium; these may resemble pus to the naked eye, but are at once distinguished by microscopic examination.

Pus may be formed on the free surface of a part, and be thence discharged; or in the int[illegible] lodge there. In the latter case, the immediate effect [illegible]ies according to the nature of the part. If loose a[illegible] ordinary areolar tissue, the pain and throbbing ofte[illegible] events, diminish; and the swelling becomes paler, [illegible]. If, on the contrary, the texture be dense and unyielding, as the oss[illegible]us and fibrous, the general inflammation, with its indications of tensio[illegible] redness, heat, and pain, is much aggravated.

The result also depends on the form of disease which has preceded. If it have leisurely advanced through its successive stages, the pus is not secreted till a barrier of plastic fibrin has been formed, which protects the surrounding parts—as in the ordinary abscess. But if a rapid transition have been made from the origin to the acme of the inflammatory process, no fibrinous limitation is interposed; the exudation is wholly aplastic; the pus is infiltrated diffusedly into the neighboring tissue, softening and breaking it up, and causing its destruction by ulceration and gangrene—as in phlegmonous erysipelas.

We have just seen that, on the occurrence of suppuration, the local inflammatory symptoms sometimes subside, sometimes become aggravated. A change also usually takes place in those of the general disorder, or inflammatory fever. Its first appearance was attended by a rigor; and the same phenomenon usually indicates the approaching change. The inflammation continuing, the fever may continue also; it may increase with the inflammation's increase, or subside with its decay. Usually, the rigor is followed by a marked remission of all the febrile symptoms; which either continues until resolution is complete, or is superseded by the accession of febrile action of another type—the *Hectic Fever*, described in a former chapter (p. 42). And this is sure to occur, when the suppuration is profuse and long-continued, especially in an internal organ important in the animal economy; or when the patient is of an already debilitated frame.

Of course, it is found to vary in duration, intensity, and issue; according to the nature and duration of the cause which called it forth. On removal of the cause, recovery is often extremely rapid.

Many imagine that the accession of hectic fever is attributable to an admixture of pus in the circulation. But it seems more reasonable to assign, as its cause, a very opposite circumstance; namely, the constant draining away of that portion of the blood, its liquor sanguinis, which is peculiarly available for the purpose of nutrition. Pus we have seen to be a perversion of that portion of the blood; and the habitual loss of it seems much calculated to impoverish and weaken the frame; inducing febrile disturbance of healthy function, with debility as a prominent characteristic of such disorder. Pus, directly mixed with the circulation —if not speedily extruded by elimination—produces a much more grave disturbance of the system, as will afterwards be considered.

During profuse suppuration, it is not unlikely that a portion of the pus may be taken back again into the system. Yet it is not a fluid easily absorbed; inasmuch as its solid particles are of large dimensions, and not fitted for passing through unbroken membranous coats. Its serosity may pass readily; but the corpuscles, when absorbed, must surely undergo some previous modification—softening, and breaking up. So, if we are to suppose that the blood is contaminated by pus in hectic, it must be by absorption of it, and not by its direct intermixture; and, besides, the absorbed pus must be a modified form of that fluid. And, again, such modified admixture of pus cannot be essential to the production of hectic, seeing that that form of disease occurs without any apparent purulent formation; for instance, as a consequence of protracted organic disease in some internal part, of whose condition suppuration is not and has never been an element.

When pus is formed rapidly after the onset of inflammation, and is diffused into the surrounding textures, from want of antecedent protective exudation of fibrin, the injury, as already stated, is great; by infiltration, softening, disintegration, and gangrene. The constitutional symptoms attendant thereon, are not those of Hectic, but of *Irritative Fever* (p. 44). In the part, advancing destruction of texture is preceded by spreading inflammation, of a rapid and intense kind. The disease tends to rouse the system; while its result on texture has the directly contrary effect—producing general depression. It need not surprise us, therefore, to find the general disorder consisting of febrile excitement, modified and overborne by depression of the vital powers. The pulse is frequent and hard; at first with indication of strength, but soon betokening manifest debility. The tongue is usually tremulous, and covered with a thick, dark-colored, offensive fur; moisture gradually leaves it, and it ultimately becomes hard, brown, and dry. The urine is scanty, high-colored, and of unpleasant odor; sometimes apparently suppressed. Sometimes there is diarrhœa, sometimes constipation. Rigors are frequent; followed by perspiration, usually profuse. There is much restlessness, with agitation of manner, anxiety of expression, and pinching of the features. Respiration is hurried and sighing, and there is a sensation of oppression at the chest. The mind is either greatly depressed, or excited by occasional delirium. The strength is much prostrated; hiccup sets in; and then fatal collapse is imminent.

Under certain circumstances, more particularly in connection with wounds, it is not unfrequent to find abscesses developed in many parts; either at once or in close succession. And, at the same time, constitutional symptoms may occur, of a typhoid character—by some termed *Pyæmia*, and ascribed to direct admixture of pus with the circulation.

IV.—*Ulceration and Sloughing.*

Until lately, the Hunterian theory was generally received, that ulceration, or the process whereby a breach of continuity is effected in a living solid, by the action of the part itself, was the exclusive work of the absorbents.

There is every reason to believe, however, that ulceration may be more properly regarded as a *molecular death;* a gradual softening and disintegration of tissue, molecule by molecule; the effete matter being mixed with purulent or other secretions of the part, and thus carried out of the system. This process is generally one of true inflammation; or is, at all events, connect of the inflammatory process.

The steps of the pr inflammation, with suppuration, and softening of part; 2. Disintegration—or death and detachment- , or molecules; 3. Mixture with the pus, and remova scharge. With this process, absorption can have little or nothing

The more important arguments in of this doctrine are the following:—1. Ulceration is an imn ult of inflammation, or is coexistent with it; and, during i n, absorption in the part inflamed is very much diminished, gether arrested. Inflammation simply subsiding, on having just l its true acme, or barely so, is followed almost immediately by very actively renewed absorption, by which the inflammatory deposits are speedily cleared away. But when the inflammation does not so subside, and advances to suppuration with ulceration, the result is otherwise; absorption is not renewed with any energy, if at all, until the disease has abated. During ulceration, inflammatory deposits may indeed, to a certain extent, disappear; but only by disintegration along with the original tissues, and admixture with the extruded purulent discharge. 2. If ulceration consist in mere absorption, why is it invariably accompanied by discharge? 3. Certain structures resist all excitants of absorption, long and successfully, yet are remarkably prone to ulceration; and the inference seems plain that the two processes—one opposed, the other embraced, by the same part, and at the same time—must be dissimilar. Malignant tumors, for example, will not diminish in their true structure, far less disappear by absorption; yet they are apt to ulcerate spontaneously, and are certain to ulcerate when unwisely and rudely stimulated, as by friction or pressure. Again: the lining membrane of an abscess is notoriously deficient in absorbent power; and yet how often does it rapidly disappear by ulceration? 4. In the case of virulent inoculations, whence the system is to be contaminated by absorption of virus from the part inoculated—as, for instance, in the primary venereal ulcer—it is considered that the system is safe during the *formation* of that ulcer. The part inflames and ulcerates; in no long time after the first blush of inflammation, the ulcer is fully established; and during the first few days, according to the Hunterian theory, there should have been great and constant activity of the absorbents, pouring virus into the circulation along with the *debris* of texture. But the experience of the practitioner tells an opposite tale; there seems to be little or no absorption during that period; and if he have an opportunity of then destroying the part with caustic, the disease is arrested; inasmuch as, up to that time, it has been entirely local, and has not been disseminated, by absorption, throughout the system. 5. Ulceration is most rapid, when absorption is generally supposed to be least active; that is, during the persistence of acute inflammation. 6. Passive venous congestion, in a part, is directly opposed to absorption. Yet it favors ulceration, by proving a strongly predisposing cause to inflammation; which, occurring in a part of low vital power, passes on almost uncontrolled to a high result, namely, disintegration. All new formations are prone to ulceration in a similar way, being of low organization and weak vital power. Granulations, for instance, are so situated. They are liable to both absorption and ulceration; and these are found to be distinct and very different processes. By the former, the new formation is diminished gradually in bulk, contraction of the surrounding original textures is favored and enhanced, the extent of cicatrix is diminished, and union is rendered compact and firm; by the latter—preceded and probably accompanied by inflammation—the cicatrix is undone rapidly, and the breach is made wide and gaping as before. 7. A part to be the seat of ulcerative absorption, must be previously reduced to a state more or less fluid. But this fusion of solid parts is one of the direct results of the inflammatory process; and to constitute ulceration, it only requires the addition of molecular disintegration, or detachment, of the parts so changed, which then mingle with the purulent fluid to form one common discharge; an idea which seems infinitely more feasible, than to suppose absorption to be suddenly and actively resumed for a special purpose, during the persistence of an action avowedly inimical to that function. After the disintegration and solution, a portion of the *debris* may be subsequently taken up by absorbents; but these vessels are then dealing with the results of ulceration, not effecting that process. 8. Absorption is proved to be feeble during acute ulceration. A strong narcotic, in the fluid form, may be then applied to the part with comparative impunity; while, subsequently to abatement of the ulcerative action, a much less dose will produce a much greater effect if brought in contact with the raw granulating surface.

In fact, the Hunterian theory of ulceration must be regarded as founded on an entirely hypothetical and questionable view of the action of the absorbents; whereas, the existence of disintegrated tissue, in the discharges from an ulcer, is a fact which may be indisputably demonstrated. This will be clearly seen, in treating of ulceration in different tissues; especially in bone.

Ulceration may occur either in an unbroken part, or where there has been previously a breach of structure. The process is begun by inflammatory change, which sooner or later reaches its acme, with suppuration. It does not stop there, but advances a step further. To infiltration, softening, and partial breaking up of texture (true inflammation), are added further softening and molecular disintegration—true ulceration. On an open surface, the *debris* mingles with the purulent discharge, and so escapes. On a surface previously unbroken, the discharge accumulates in the form of a pustule or small abscess; this breaks, its contents are evacuated, and the ulcerated surface is then disclosed beneath. So long as true inflammation continues, ulceration does not cease; the greater the amount of perverted function, and the less the amount of vital power, the more rapid and extensive is the work of destruction. With moderate inflammation, and considerable power of control in the part, ulceration advances steadily; presenting the usual characters of the *Acute* form of that process. With higher excitement, destruction is more rapid, very painful, and accompanied by greater redness, heat, and swelling; as in the form of ulcer to be afterwards described as *Inflamed*—from unusual prominence of the symptoms of true inflammation in and around the diseased part. With still higher excitement, or with the same combined with less local power, destruction is more rapid still; as if the part were consu iving agent; as in the ulcer termed *Phagedænic*. ; increased, and local power impaired—one or other n is still more speedy, but in a different form; the in molecules, but in mass; ulceration is merged in *ughing* sore is said to exist.

On the other hand, inflammation, hav once established ulceration, may speedily subside; the latter proc under such circumstances, soon ceases, and is followed by reparat Or inflammation may remain, in a subdued form; and then ulceration advances stealthily and slowly, and is said to be of the *Chronic* ty .

The more active the ulcerative process and its accompanying disintegration, the less laudable is the purulent discharge. Inflammation either persisting or advancing, the discharge is thin, acrid, not unfrequently bloody, and more or less impregnated with the softened *debris* of texture. When, on the contrary, the disease has not only subsided from the inflammatory standard, but is becoming insufficient even for reparation, the discharge is almost entirely serous.

By some, it is supposed that ulceration may be occasioned directly by passive venous congestion—as in the lower limbs; and they consequently speak of the Congestive and Inflammatory, as different forms of ulceration. But congestion is only the predisposing cause, not the immediate; it favors the occurrence of inflammation; and this coming, finds the part possessed of but little vital power—as, indeed, the existence of such congestion plainly indicates. Suppuration and ulceration are soon reached; not the direct result of congestion, but of inflammation which congestion has induced and aggravated.

Certain tissues are more prone to ulceration than others. Skin, mucous membrane, and areolar tissue, are peculiarly liable to fall before it; while the vascular, nervous, and fibrous tissues resist it stoutly. Often advantage is derived from this; sometimes evil. The comparative immunity of the nervous and vascular tissues is plainly beneficial. And, in like manner, it is often fortunate that important parts are protected by fibrous expansion; which can successfully resist, at least for a time, the encroachment of advancing suppuration. But when the purulent collection is bound down by a fibrous layer, then mischief is likely to accrue; inasmuch as the natural tendency of the pus outwards—by ulceration of intervening texture—is opposed, while deep and important parts may suffer sadly by the delay.

The *Causes* of ulceration are the same as those of inflammation.

These diseases are portions of the same general process; which commences with simple vascular excitement, and may end in gangrene. Ulceration is the higher grade; intermediate between suppuration and gangrene. Something more than the former; for there is disintegration with solution of texture, as well as the formation of pus. Something less than the latter, the part not dying and being detached at once, in a continuous mass, but slowly and by molecules. Whatever favors the occurrence and continuance of true inflammation, and whatever is unfavorable to due maintenance of vital power in the part whereby inflammation might be resisted or controlled, is a cause of ulceration.

Inflammation subsiding, so does ulceration; and the action of destruction is followed by that of reparation—granulation. The succession may be rapid or slow. On the occurrence of gangrene, the dead part is separated from the living by ulceration; and, in the furrow so formed, the two processes of destruction and reparation are usually seen at work together and in harmony. The ulceration, in this case, has not proceeded much deeper than the true skin, when already in the true skin granulations are being formed; as if with the view of at once closing the breach, and atoning for the loss of substance. And, on the other hand, we find many a breach of surface in the lower limbs, in which ulceration has for weeks ceased, but in which there may be no effectual reparative effort for many weeks to come.

Ulceration is often attended by marked constitutional symptoms. If acute, inflammation persisting, there is febrile disturbance of the inflammatory type. If chronic and tedious, with a profusion of discharge, hectic may ensue. If phagedænic, irritative fever exists; often of a grave character. The sloughing sore is not unfrequently accompanied by typhoid symptoms.

Loss of substance may be caused otherwise than by ulceration. It may be the result of mere absorption, interstitial or continuous; a gradual process, independent of true inflammation, and unaccompanied by suppuration.

Sloughing.

Death of the part, an undoubted termination of inflammation as well as of all other vital change, may be reached at once; from intensity of disease, deficiency of power, or a combination of both. Or the intervening stages of suppuration and ulceration may have been either barely touched at, or more or less dwelt upon. The broken-up texture softened, and infiltrated by liquor sanguinis, pus, and extravasated blood, has its circulation wholly arrested; and it dies; not by particles, slowly and almost imperceptibly, but plainly, at once, and in mass. Vital
has ceased, chemical change advances unopposed, and the part is
sed by putrescence.

re the results of the inflammatory process; some antecedent,
equent to the true inflammatory crisis. Deposits of serum,
both; attendant on the two preliminary grades of the process,
xcitement, and Active Congestion; the fibrin organized or
he exudation more or less permanent, according to the persis-

tence of the perverted functions which occasioned it. Escape of blood, in the form either of hemorrhage or of extravasation, by giving way of the vascular coats during any period of the more advanced part of the process. Formation of pus, with extravasation of blood, softening and disruption of texture; attendant on the period of true inflammation. Beyond this, disintegration and solution are added to softening and disruption of texture; to constitute true Ulceration; the inflammation is continued—not only not having subsided from its acme, but persisting until a still higher result is attained. Or circulation is wholly arrested, vital function ceases, and chemical change begins; the part is dying, and dies—not in particles, but in one continuous mass; Mortification.

VARIETIES TORY PROCESS.

Many and various ha ons connected with this part of the subject. Perhaps the most imp ant is that into *Acute* and *Chronic*. In the one case, the disease dvances with more or less rapidity through its various stages; and, ving reached a climax more or less elevated—suppuration, ulceration, or gangrene—declines with a corresponding degree of alacrity. In the other, the time occupied is not as in the former a period of days or h urs, but perhaps of weeks or months. The disease begins of a sluggish type, and retains that character throughout; dwelling long on the minor stages; seldom reaching to suppuration or ulceration; and still more seldom to gangrene; hovering rather on the other side of the true inflammatory crisis, and consequently dangerous to normal structure, by favoring fibrinous exudation and its subsequent organization. When, after having reached its climax—however low—it begins to subside, the decline is proportionally gradual; and it proves unsatisfactory, because not only tedious but imperfect.

The two forms may be commingled. The disease may be at first acute; receiving a check, by treatment or otherwise, it does not wholly recede, but merely dwindles down into a subdued form, and there remains, becoming chronic; chronic, because moderated. For it is often found to be a tolerably true axiom in this vital warfare, that the hotter the action the sooner the restoration to peace. Or, in other words, the inflammatory process is often not only brief when intense, and protracted when of a gentle kind; but brief because intense, and capable of lingering because of a gentle grade. A part under violent inflammation is either soon restored, or quickly perishes; under a mild form, it may bear up for a long period. Again; the inflammation may be at first, and for long, chronic; but, by the application of renewed stimulus, the acute form may be superadded, or, as it were, ingrafted on the chronic. And this is an occurrence invariably fraught with imminent danger to texture; for, by the chronic form, structure has been materially changed, as well as vital power much impaired; and the part is so rendered an almost unresisting prey to the acute attack. This latter succession of the forms is very likely to be induced by injudicious or rash treatment; and ought to be carefully guarded against.

The acute we may consider as representing the ordinary type of the inflammatory process; already discussed. A few words will suffice to indicate the peculiarities of symptoms and results connected with the chronic form.

Symptoms of the Chronic form.—The disease being both mild and gradual, the symptoms are comparatively little developed, and hence sometimes obscure. Redness, swelling, pain, heat, are slight; and of the two last, sometimes there is almost nothing. Swelling, however, though at first slight, ultimately becomes a prominent and most important feature. It is considerable in extent—for it has been of long continuance, and steadily, though slowly, increasing; dense and firm in character—exudation either consisting chiefly of fibrin from the first or the serum having become absorbed; and tending to permanency of duration—having been by time and nature rendered prone to organization. There is seldom any degree of tension; for, the deposit having taken place gradually, the parts have duly accommodated themselves to its reception. Suppuration, ulceration, and gangrene, when attained to, are, like the process which preceded them, slow and gradual in their advance to completion; attended by the ordinary symptoms of such results, in a mitigated form. Rapid and tense swelling, with softening of texture, we saw to be characteristic of the acute form; gradual enlargement, with induration, is characteristic of the chronic. The function of the part is often not less involved in the chronic than in the acute form, at least when a considerable part of an organ is affected by disease.

The constitutional symptoms are proportionally mild. Febrile disturbance may be so slight, as scarcely to be appreciated by either the patient or his attendant; and, when perceived, it is often both so obscurely marked and so transient, as to baffle or deceive in the effort of tracing it to its cause. The most prominent symptoms are:—want of refreshing sleep; loss of appetite; emaciation; change of color, in the general surface, to a pale or dirty yellow; occasional flushes; sensation of cold, and frequent inclinations to shiver; impairment of strength, and a general feeling of uneasiness; the patient feels that he is ill, yet scarcely knows how or where. In the severe forms, the febrile condition is more marked, and partakes more or less of the inflammatory type:—headache, heat, frequent and hard pulse, dry skin, scanty urine, thirst, restlessness. Yet, the local disease remaining chronic, the fever never attains to the form of the truly inflammatory; it is less sthenic, less marked, less progressive, less continued; in fact, it is a form of Constitutional Irritation (p. 78). The tendency to remission, sometimes almost complete, is one of its most distinctive characters; the period of exacerbation is evening, or the early part of the night: morning, that of remission, with or without perspiration. Sometimes the local disease itself deceptively assumes somewhat of the remittent character; seeming to have abated, or even ceased, during several days; while all the time it was steadily though stealthily advancing.

It should never be forgotten, that however slight and apparently trivial the constitutional symptoms of a chronic inflammatory process may be, yet, by their mere persistence, they are likely to exhaust the frame, and induce a fatal termination.

On the occurrence of suppuration, they readily change into Hectic (p. 42). Gangrene having taken place, the Typhoid form is speedily assumed (p. 40); low, and tending still downwards, from the beginning. An acute accession having been unfortunately superinduced, the true Inflammatory fever (p. 37) may be assumed, at least for a time; but, more frequently, the effort towards sthenic disease is but partially successful, and results in fever of the Irritative form (p. 44).

The *Results* of the Chronic Inflammatory process are thus seen to be chiefly formidable by long continuance of the disease, and by the insidious nature of its progress; change of structure, all but irreparable, may have occurred, before the attention of either patient or practitioner has been directed to the part. Gradual alteration of structure is the most ordinary result; by interstitial deposit, of a fibrinous kind, which becomes more or less highl[illegible]ration, ulceration, gangrene, though comparatively ra[illegible] occur. They can scarcely be avoided, if the chro[illegible] after having for some time existed, suddenly becom[illegible]e inflammation.

Another important divis[illegible]thenic and *Asthenic*. The former follows the ordinary course of [illegible] inflammatory process, and shows no tendency to spread rapidly or d[illegible]sedly; pus, when formed, is surrounded by plastic fibrinous exudation; and the constitutional disorder is of the Inflammatory type. Such is the inflammation which constitutes an ordinary acute abscess, after injury.

The asthenic variety tends to spread; exudation is not plastic; suppuration is soon attained, and the pus is not laudable; the parenchyma is open to infiltration; destruction of texture is imminent; and the attendant constitutional symptoms are those of Irritation, often of a low and grave kind. Such disease is well exemplified by diffuse cellulitis, and the worst forms of erysipelas. There is good reason to suspect that the blood is in a depraved state—favorable to suppuration—previously to the inflammatory attack; and that this morbid condition of that most important fluid becomes aggravated by the progress of the local disorder. Occasionally, the exciting cause is directly concerned in the unfavorable type; as in the case of inoculation by poisonous matter.

It needs hardly to be stated that energetic treatment, often demanded in the sthenic form, is in the asthenic wholly unsuitable.

THE MANAGEMENT OF THE INFLAMMATORY PROCESS.

Prevention.

Therapeutic means, applied immediately after removal of the exciting cause, may have the effect of entirely frustrating its ordinary operation, and preventing inflammation. For this purpose, the period of incubation must be diligently improved. But, to insure success, it is not only necessary, as can be readily understood, that the suitable means be early and sedulously employed, but also that the cause shall have been slight as well as transient; that its removal shall have been entire; and that the part have its vital power as yet unimpaired. The first effects of the stimulus we saw to be an impression on the nervous system; if not itself morbid, at least tending to a morbid result. The first object of preventive management, is to mitigate or remove this. By some, hot water, or its steam, is applied constantly; and it is not unlikely to succeed in subduing the nervous excitement—or breaking off the first link in the chain. But the second step of the initiatory process, seldom far disjoined from the first, we saw to be excitement of the vascular system of the part; and this system is likely to be further stimulated, by the heated applications by which the other is soothed. Cold, continuously applied, is therefore preferable; inasmuch as it is calculated to fulfil a twofold indication, by exerting a sedative or depressing effect on both the nervous and vascular systems of the part, and so rendering accession of the inflammatory process still more improbable. Absence of the two first links of the chain is likely to frustrate the formation of the whole.

But this simple remedy requires nicety and care in its application. The first effect of cold, as formerly stated, is sedative, the second reactive; the first is opposed to vascular excitement, the second invites its occurrence; the first we desiderate, the second we wish to avoid. To be prophylactic, therefore, its application must be continuous; if interrupted, however briefly, reaction is imminent—not only to arrest, but to undo the good effects of all the previous precaution. The part is covered by a loose layer of fine lint, and a trustworthy attendant keeps this constantly moist and of low temperature, by cold water frequently and gently dropped on it out of a sponge; the slightest dryness or warmth being dreaded, as a source of disaster and disappointment. Or the assistant may be dispensed with, and a process of constant irrigation employed; a thin strip of lint, or a skein of cotton, being arranged as a syphon in communication with the part, and a water-vessel placed in its immediate vicinity. The bed-clothes, if need be, are protected by the interposition of oil-cloth; arranged slopingly, so as to favor the draining away of the water, after it has trickled over the seat of injury. The part is to be kept rigidly quiet, or at least as much so as circumstances will possibly permit; and it should also be so placed, as to favor venous return and oppose arterial influx; at the same time relaxing those muscles which are either directly or indirectly implicated. Low diet, too, with abstraction of all stimuli, whether local or general, must be strictly enjoined.

Parts simply stimulated—that is to say, without wound—may by such treatment be altogether saved from inflammatory accession. And many incised wounds may thus be brought to rapid and almost painless healing, by *adhesion;* the inflammatory process not having been wholly prevented, but being kept so subdued and limited as never to reach even the vicinity of the true inflammatory acme. It is only sometimes that we are able to avert every part of the inflammatory process; but in many cases we may prevent that advancement which constitutes true inflammation.

Treatment.

Removal of the cause ought assuredly to be the first care of the practitioner, when called to subdue inflammation. That preliminary point having been successfully carried, he will then be enabled to attain his principal object by the use of comparatively slight means; with little trouble to himself, and at the expense of comparatively little pain, annoyance, delay, or danger to the patient. Whereas, let the all-important preliminary step be either neglected or imperfectly secured, and the most powerful remedial means may be unceasingly employed, with little or no avail. A patient applies for relief, on account of nascent inflammation of the conjunctiva, caused by the lodgment of foreign matter in that membrane. Remove the particle of dust or sand at once; and fomentation, a shade, a purge, careful diet, with perhaps a few leeches, will, in the great majo[illegible] to dissipate even the most formidable of such affec[illegible]ys at the utmost. But, on the other hand, leave th[illegible]edded in the inflaming part; and leeches innumerabl[illegible] arm, or from the temporal artery, once and again; [illegible]uccession; purges; antimonials; mercury pushed to profuse [illegible] and perhaps repeated—in short, ruin to the system, by severity [illegible]tment, may be enforced and endured, without arresting the [illegible] preventing loss of vision by irreparable change of structure. [illegible] mere fancy. Cases are on record of eyes having become pe[illegible] and sightless, notwithstanding the induction of anæmia, drop[illegible] mercurial disease, by the attempts to save; all the while, some sm[illegible] particle of foreign matter lodging undisturbed, and probably unsuspected, in the lining of the upper eyelid—the simple removal of which source of excitement might have preserved both sight and system for the patient, as well as credit and conscience for the practitioner.

Our first duty is to inquire carefully for the exciting cause. If already removed, good and well; if still in operation, we are to procure its abstraction as speedily and effectually as may be in our power. And then we are in a favorable position to proceed with the directly remedial means—those which, being opposed to advance and persistence of the inflammatory process, are termed *Antiphlogistics*. The most important of these is *Bloodletting;* and the blood may be taken, either from the part, or from the system at large.

1. *General Bloodletting.*—In the outset it is to be observed, that this is not invariably necessary. It is a spoliative remedy, of the highest class; and therefore never to be had recourse to, unless circumstances declare it either imperatively demanded, or at the least highly expedient. There is every reason to fear that this little operation is still too frequently employed;—unnecessarily, when it might have been well superseded by other and more gentle measures;—unwarrantably, when actually no benefit, but sad injury, has flowed from and with the "purple stream." It is a very easy matter to take away blood, and thereby induce debility; while to undo that result, is in most cases difficult, and often impossible. Congestions, serous effusions, bloodless skin and mucous membrane, atrophied and all but palsied muscles, a withered frame and an enfeebled mind, may remain, silent, yet steadfast and truth-declaring witnesses of the error in practice. On the other hand,

the practitioner will be equally culpable who refains from this operation, when the circumstances of the case call plainly and loudly for its performance. And it may be stated broadly, that general bloodletting is required, when the inflammatory symptoms—local, general, or both—are severe, as in many examples of compound fracture; when the part affected is of importance in the animal economy—as the lung, bladder, or kidney; or when a delicacy of texture is involved, whose maintenance is essential to important function—as in the eye, in the synovial membrane, and in the nervous tissue in general.

Bleeding is not to be regulated by its absolute amount, but by its effects. No idea should be entertained, that in one form of disease a certain number of ounces will suffice; while in another, a greater, and in a third, a less amount must be invariably taken. In every case, the thought of measure is to be abandoned; blood is permitted to flow on, until the desired effect has been obtained; and then the stream is arrested, irrespective of whether the ounces amount to three or thirty.

In connection with this point, it is further to be remembered, that true inflammation engenders a *tolerance* of this remedy. A young, robust, healthy man, may be bled when he does not require it; but, most probably, twelve or fifteen ounces shall not have flowed, ere Nature interposes her objection to the procedure, and syncope is produced. Whereas, open a vein in the arm of even a weak, pale-faced, nervous patient, who is the subject of an acute inflammatory seizure in some important part, and it is not improbable but double that amount or more shall have been withdrawn, ere any considerable effect has been made upon the system. So truly and generally does this obtain, that an important auxiliary in diagnosis may be thence derived. You are bleeding a patient; in doubt whether the disease is truly inflammatory or not; but you suspect that it is, otherwise it is likely you would not have performed venesection; only a few ounces have escaped, when the patient grows pale and faint; you arrest the flow, and reconsider your diagnosis, suspicious of an error. But should no faintness threaten after a full or even large abstraction, doubt is removed; your diagnosis is confirmed; you advance unhesitatingly with antiphlogistics; the disease is there, and has engendered a tolerance of the remedy. On coming to a conclusion from this test, however, care must be taken to ascertain that the syncope, or tendency thereto, is an actual failing of nature; the effect of the loss of blood; not the result merely of fear, or other depressing agency, on the patient's mind. When aware that the patient is naturally timid, and liable to faint from this cause; and when at the same time confident that he labors under inflammatory disease, and that the circumstances demand effective bloodletting—we bleed him in the recumbent posture, and with a gentle stream.

Tolerance of bleeding will also be found to vary according to the sex, age, and temperament of the patient; greater in the male than in the female; least in the lymphatic, greatest in the sanguine temperament; greater in adult age, than at either of the extremes of life; in early infancy it is most especially small; in advanced years loss of blood is not likely to prove so obviously and directly calamitous, yet is a spoliation hard to be borne. Tolerance also, be it remembered, is but temporary;

great at the beginning of the inflammatory change, it ceases towards the end.[1]

Similar tolerance of appropriate remedies seems often to be generated by disease. In fact, it may be laid down as almost a general rule, that a remedy—in itself severe—may, when appropriate to a given form of disease, be administered in even large quantity during the persistence of that disease, with not only relief to the symptoms, but with comparative impunity to the system at large; whereas the same remedy, given even with a sparing hand, while no such call for its employment exists, is likely to affect the constitution injuriously. In delirium tremens, for example, opium has sometimes to be given in large doses; a tithe of which would fatally poi[illegible] health (p. 85). In pneumonia, tartrate of antin[illegible] extent which would, under other circumstances, be [illegible]le. In iritis, synovitis, and certain forms of the ven[illegible]ch the use of mercury is not only expedient but esser[illegible]n be pushed with safety; it is to the sakeless salivations—errors either of judgment or of diagnosis—that the ruin of mercurially-shattered fi[illegible]nes is attributable.

The Effects of general bloodletting, in [illegible] far as they are remedial of inflammation, are—1. A sedative result on the heart's action, and on the general circulating system; effected partly by withdrawal of its wonted stimulus, the blood, from the central organ; and partly by the depressing effect of sudden loss of blood on the nervous system, which reacts in a corresponding strain upon the circulation. And this sedative effect on both heart and arteries is proportionally indicated, by diminution of the hardness and thrilling of the pulse, as well as of its fulness and frequency. It is plain how such a lull is advantageous, as regards both the local vascular excitement and the fever which accompanies it. 2. The blood is diminished in absolute volume. In some cases this is not desirable; on the contrary, we may be not more anxious to crush rising inflammation, than to husband the vital resources already weakened, and especially to retain this all-important fluid unwasted; we therefore bleed sparingly if at all. Yet there are cases in which the blood is preternaturally increased in quantity, as well as changed in character—as in inflammation occurring during well-marked plethora. In such circumstances, diminution of its volume will favor resumed general control of circulation; at the same time lessening the probability of sanguineous determination to any individual part. Again: in inflammatory affection of the chest, in connection with wound, while one lung is collapsed, and the other is laboring with its increased burden, mere diminution of the blood's bulk is obviously calculated to afford important relief. 3. The blood is also affected somewhat as to its component parts. These do not pass out from the open vein in their ordinary and equable proportions, but some more than others; at first the red corpuscles escape most freely; and at length the proportion of albumen is somewhat diminished. After repeated and extreme bleeding, the fibrin also will be found of less quantity in the blood which remains in circulation. 4. Derivation of blood is effected, from other parts to that whence the blood issues; the inflamed part probably benefiting in an especial degree. However this is produced—whether according to mechanical or vital laws, or both—microscopical observation, corroborating what had been previously inferred from experience, has established the fact that it does occur. Place an inflaming part beneath the field of a microscope, and draw blood by a puncture from another, even distant point; blood will be seen actually leaving the inflaming part, to meet the increased demand elsewhere; and even stagnant portions will be seen to disentangle themselves, and to resume a brisk movement, for the same purpose. This derivative effect is plainly in favor of the burdened part. It may be that it is but temporary, ceasing almost with the flow that caused it. Yet, granting such to be the case, still an important advantage has been obtained; inasmuch as even this temporary relief may be such as to enable the capillaries in some degree to recover their tone, and the parenchyma to accommodate itself better to the temporarily diminished exudation. 5. The action of other remedies is facilitated. "By lessening that morbid impetus of the blood (and increased tone of the vascular coats) by which, during the state of inflammatory fever, the natural excretions are apparently impeded, and at the same time by promoting absorption into the blood (as loss of blood is well known to do), it favors the effect of all other evacuating remedies intended to act on the excretions of individual parts of the system."[1] And further, by its precedence, it renders certain remedies—as mercury and opium—decidedly beneficial, which otherwise would have proved either inoperative, or absolutely injurious.

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[1] Tolerance of bleeding in inflammation is attributed by Dr. Williams to "increased excitability of the heart and tonicity of the arteries, which maintain a sufficient force and tension to preserve the circulation, especially through the brain, even when much blood is lost. In asthenic or atonic diseases, on the other hand, the arteries being lax, and ill-fitted to transmit the blood, a smaller loss is felt, and syncope may result."

These beneficial results of bloodletting are materially affected by the manner in which the blood is withdrawn. As already stated, it is desirable, in the great majority of cases, to obtain the resolutive effects at a cost of as little blood as possible; and, with this view, the manner of abstraction becomes all-important. Make a large orifice in a vein or veins, let the blood escape in a rapid, full stream, with the patient in the erect, or semi-erect posture, and syncope is soon arrived at; these circumstances tending to sudden withdrawal of wonted stimulus from the heart, and diminution of arterial supply to the brain. Whereas, blood may be taken in large quantity—especially when tolerance by disease exists—from a small aperture, in a slow and small stream, during recumbency; in fact, the system may be thus almost wholly drained of blood, ere faintness threaten to ensue. And thus we see how slow venous hemorrhages, of accidental origin, prove so dangerous; faintness, so favorable to the spontaneous and effectual arrest of the flow, by formation of coagulum, being too long deferred. Syncope may be, in truth, regarded as Nature's safeguard from hemorrhage. In the case of accidental wounds, it usually supervenes ere actual danger has accrued from the loss; allowing the vascular orifices to contract, and to become occluded by coagula. When blood is designedly taken in the treatment of disease, and when it is proper that blood should be so taken, there is tolerance; or, in other words, syncope remains in abeyance, till a sufficiency shall have passed away. But should an error of judgment have been committed by the practitioner, Nature is ever watchful to retrieve it; and, where blood is flowing when it ought not, very little is lost ere syncope ensues, and arrests the stream.

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[1] ALISON. As local absorption is in comparative abeyance during inflammation of a part, so general absorption is diminished during the inflammatory fever. Most constitutional remedies act on the system, by being absorbed into it; and, consequently, bloodletting by allaying this fever, favors the absorption and action of other antiphlogistics.

In antiphlogistic bleeding, then—except in the comparatively few cases in which actual loss of blood is desirable—the abstraction is made rapidly, in the erect or semi-erect posture. But syncope is to be approached, rather than actually attained. Our object is, not only to produce, but to maintain a s[illegible] heart and general circulation. If syncope occur, reacti[illegible] to prove excessive; whereas, if the immediate result [illegible] is more easily retained; by stopping short of actu[illegible] reaction is rendered both less probable and more [illegible] Besides, a faint may prove in itself somewhat dangerous; if there be [illegible]ither organic disease in the heart, or considerable effusion in the peric[illegible]lium, cessation of the heart's action may prove permanent. So soon, [illegible]erefore, as the symptoms of approaching syncope show themselves, we usually desist from bloodletting; when the patient grows pale, and articulates faintly and with difficulty; when he begins to fail from the semi-erect posture, sighs, and shows signs of nausea; when the lips grow dry, white, and quivering, the eyes dull and glassy, and a cold sweat bedews the face and forehead; when the pulse becomes weak and fluttering—then we bind up the arm, and place him gently recumbent. About twenty ounces may be estimated a fair average first bleeding, in a case of inflammation attacking a robust adult; but, in most cases, as already stated, it is better to keep mechanical admeasurement altogether out of the question.

From depression by bleeding, the circulating system rouses itself, more or less rapidly; and the result is termed *Reaction.* This either remains of a tolerably quiet and subdued character, the inflammation having simply given way; or it becomes excessive. And excessive reaction may be of two kinds. 1. It may be of an *asthenic* or nervous character; indicated by rapid, soft, and jerking pulse, oppressed breathing, headache, and tinnitus aurium, general nervous excitement, and non-return of the ordinary inflammatory symptoms—a state of system very similar to what follows simple loss of blood in large quantity. To bleed again, would be to aggravate such disorder. A full opiate is administered; the nervous excitement is allayed; the patient falls asleep, and may awake with a calm pulse and system, relieved as if by the working of a charm. The opium here does not create the sedative impression on the circulation; given by itself, it most probably would not only have failed to quiet, but would have increased the tumult; but, coming after bleeding, it restores the sedative result which this had achieved, but was unable singly to maintain. 2. But reaction may be of an opposite kind—*sthenic;* in fact, a continuance or reaccession of the inflammatory attack. The pulse is hard and vibratory as before; the fever still retains the inflammatory character; local heat and pain are unsubdued. The inflammatory process has been interrupted, but not arrested; remission proves but transient; and the reaccession may be more fierce than the original onset. This state must be met by the lancet. A second bleeding is to be practised, so soon as such reaction has declared itself. And a few ounces drawn then, will often suffice to restore the sedative effect of the former bleeding; while double the original amount may fail to make a satisfactory impression, after time has been allowed for the reaccession to make head and be established.

The paramount importance of *Time*, in connection with bloodletting as an antiphlogistic, should never be forgotten; whether it be practised to crush the rally, or to meet the original attack. Comparatively speaking, one full bleeding of ounces, drawn early—just at the onset—will be far more available, as a remedial agent, than pounds taken at a subsequent period. In consequence of delay, not only will the cure be less complete and satisfactory—change of structure having occurred by exudation, and resolution proving both gradual and incomplete; but, besides, to obtain even the incomplete cure then, the system must be sorely shaken by the severity of the treatment employed. "*Obsta principiis*" is the invariable motto of the antiphlogistic phlebotomist.

The signs of bleeding having proved effectual are, in general, sufficiently plain. The pulse loses its hardness and thrilling, becoming soft and compressible; it may be either more or less frequent than before; often the former, at least in the first instance. The local pain and heat cease, or continue in a mitigated form; the other ordinary signs recede; function returns, both in the part and in the system; secretion, general and local, is restored; and usually, if blood be drawn, it ceases to exhibit the inflammatory character. It must be borne in mind, however, that the last result is not invariable. Exceptions to the general rule, in this respect, are by no means unfrequent; and blood may be at least buffed, if not cupped likewise, notwithstanding that the disease has given way; while, on the other hand, this may be persisting, while the blood seems scarcely sizy. It therefore follows, in either case, that when the evidence of the blood is opposed to that of the other inflammatory signs, the latter are believed, and guide the practice; but, usually, there will be found a general agreement in one indication.

Certain circumstances materially affect the practice of bloodletting, and ought always to be taken into consideration. 1. The duration of the disease. At the commencement, general bleeding may be expected to produce the happiest results; at a more advanced period, a greater quantity of blood must flow, though still the effect may be in the end satisfactory; but after some considerable time has elapsed, the system may be drained of blood to an absolutely ruinous extent, and yet little impression may be made thereby upon the local disease. 2. The age, sex, temperament, and occupation of the patient. The three first have been already noticed, as affecting the tolerance of the remedy. Occupation is equally important. The robust and temperate peasant will require a larger bleeding, and bear it better, than the pale and too often dissipated inhabitant of the crowded city. And, again, among the latter class important variety is found; some—brewers' servants for example—being especially intolerant of this remedy. 3. The nature of the part affected. Many an inflammation of an external part requires no general bloodletting; while the sthenic inflammatory process can scarcely alight on any internal and important organ, without not only demanding this remedy, but apparently imparting to the system power to bear the necessary spoliation. 4. The state of the system previous to the inflammatory attack. The patient may have been plethoric. We may then bleed profusely, and in the recumbent posture; better content with a large than with a small amount of ounces. He may have been anemic. We, in that case, either forego venesection altogether, or practise it most cautiously; using every means in our power to secure the desired effect, with the least possible expenditure of the valuable fluid. 5. The ulterior result. After severe mechanical injury, it is very de secondary occurrence of gangrene; and the obvi , is by active antiphlogistic measures to mitigate t ich is setting in. But, in effecting this object, bl sparingly, and with much caution; seeing that a gangrene is inevitable, attended with its usual constitutional sy ms of depression; and, on separation of the sloughs, a profuse anc ectic-causing suppuration is equally certain to ensue. It may be ver asy, by heroic expenditure of blood, to attain the object immediately in view; but it may be very difficult to prevent the rash blow which arrests the impending inflammatory attack from at the same time annihilating the patient's chance of ultimate recovery.

General bloodletting may be effected from an artery, *Arteriotomy;* or from a vein, *Venesection* or *Phlebotomy*. When Arteriotomy is performed, a superficial anterior branch of the temporal artery is generally selected. Blood can thus be taken, both in large quantity and with much rapidity, so as to secure the desired sedative effect; but it is an operation which demands more dexterity in performance than venesection, and is, besides, not unlikely to be followed by troublesome consequences, as will afterwards be explained. A subcutaneous vein, on the contrary, is superficial and easily reached. Blood can be drawn both rapidly and in quantity, if need be, by means of a large orifice; arrest of the flow is more easily effected than in wound of an artery; and the incision is more likely to unite, simply, by adhesion. Hence, venesection is usually preferred. And the points of selection are: one of the veins at the bend of the arm, for general purposes; and the external jugular vein, in the lower part of the neck, in certain cases. In many patients, especially females affected with obesity, it is not always an easy matter to reach a vein at the ordinary sites; but, when foiled there, it does not inevitably follow that arteriotomy is the only other resource. For, if venesection be rendered preferable by circumstances, a sufficient vein—the cephalic—may always be found by a slight and sure incision, placed in the interspace between the deltoid muscle and the clavicular portion of the pectoralis major.

Hemostasis, or temporary arrest of a portion of the blood apart from the general circulation, has been proposed as an occasional, or perhaps even frequent substitute for bloodletting; or, at all events, as a useful auxiliary.[1] The blood of a limb, or of limbs, may be readily retained therein for some time; by deligation, sufficient to arrest the venous return. And this may possibly have the effect of relieving the general circulation; the sluices being afterwards slowly opened, so as to permit a gradual escape of the pent-up fluid. Such procedure is sufficiently ingenious, and not unpromising in theory; but it requires attestation by experience, ere it can be recommended in practice.

On a small scale, it is of common and successful use. By dry cupping, for example, a considerable quantity of blood may be detached, and imprisoned within the glasses, away from the inflaming part; as over the loins, in affection of the kidney.

2. *Local Bleeding.*—This is usually associated with general bloodletting; securing relief of the part, as well as of the system. It operates beneficially on both; on the part, by removing, or at all events diminishing, its sanguineous burden; on the system, by keeping up the sedative effect on the general circulation, which the general bleeding had previously produced. And, further, it is to be borne in mind, how constitutionally important is the early use of such a remedial agent directly affecting the part; inasmuch as that part being the laboratory whence issues the inflammatory change of the blood, the sooner the inflammatory process is arrested therein, the less will be the probable amount of febrile disturbance in the system.

But, under certain circumstances, local is preferable to general bloodletting, and supersedes it altogether. 1. When the inflammatory process is trivial in itself, and situated in a comparatively unimportant part, there is no reason, but the contrary, why the system should suffer, when local remedies are perfectly adequate to subjugation of the local disease. 2. When the powers of the system have been low, previous to the inflammatory accession. General bleeding being obviously from this cause inexpedient, and the local change having not advanced so far as to create a temporary tolerance of it, we content ourselves with local depletion; but, sometimes, we may carry that to such an extent, as to approach in its effects the severer form of the remedy. 3. When the inflammatory process has been fully established, and is far advanced by continuance, even great loss of blood from the arm will probably fail to produce a remedial effect on the part. To practise it, would be to weaken the frame unnecessarily. Local bleeding, even though frequently repeated, will occasion much less general exhaustion, under such circumstances; while it is dealing successfully with the disease. 4. Either extreme of age forbids general bleeding; unless in extreme circumstances. Indeed, in both the very young and very old, local bleeding, when at all considerable, is in its effects tantamount, or nearly so, to general bloodletting; and the latter will, in the majority of cases, prove not only unnecessary to the treatment, but absolutely intolerable to the system. Hence, in such patients, while general bloodletting is wholly proscribed, even local bleeding must be practised with caution and reserve.

A general rule applicable to local bleeding has been much insisted on by M. Lisfranc, and not without good show of reason; namely, that blood, when drawn with an antiphlogistic object, should not be taken immediately from the affected part, unless in large quantity. A few leeches, placed in the near vicinity of an inflaming part, relieve by drawing blood from it. They are antiphlogistic by derivation. The same number, placed on the part, draw blood from the parts around to the source of the flow; and thereby tend to increase sanguineous determination, instead of relieving it. If direct application is to be employed, the quantity taken must be large; truly spoliative; as it were, emptying the part, notwithstanding its borrowed supply from the vicinity. Local bleeding, therefore, to be antiphlogistic, must either be small in amount, and indirect in its extraction, or direct and copious. Let it be the latter, when a constitutional as well as local effect is both expedient and permissible; the former, invariably, when we are anxious to husband the general vital powe [illegible] ly the local malady. The foregoing observations, [illegible] pply to abstraction of blood directly from the part [illegible] fication, or incision; these, however slight or few, c [illegible] e part of its fluid contents; and, besides, they have [illegible] tant indications to fulfil.

Blood is withdrawn locally in [illegible] ays; by cupping, leeching, puncture, scarification, incision.

Cupping.—This, when the means are [illegible] hand, and the nature of the part is suitable to their application, is perhaps the preferable mode; less tedious and annoying than leeching, and likely to prove also more effectual. Rapidity of abstraction we saw to be useful, in obtaining a sedative effect on the system. It is similarly useful when directed upon the part. Much blood may require to flow by the slow oozing of leech-bites, ere the spoliative and sedative result is obtained. Half the quantity, suddenly removed by cupping, may prove equally or even more successful.

This little operation is performed in the following manner: The surface is first hotly sponged; and then the cups, duly exhausted by a spirit-lamp, are fixed on the parts whence the blood is to be taken. This creates a determination to that portion of the surface; at once facilitating abstraction of blood, and causing a derivation—itself favorable to the inflaming texture. By heat and moisture, this determination to the surface is maintained throughout the operation. The cups having been removed, the scarificator is instantly applied to the red and swollen parts. The instrument is pressed lightly on; and the range of the lancettes is so modified, that they shall not penetrate more deeply than the true skin; otherwise the adipose tissue fills the wounds, and arrests the flow of blood. The scarificator, so soon as it has been discharged, is replaced by a hot sponge; and this again by the glass, fully exhausted; yet not too much so, otherwise pressure may be so great as to obstruct the circulation of the part. The changes are made as rapidly as possible. The blood, as it escapes more or less freely, rises to fill the vacuum. So soon as it begins to coagulate—or sooner, if the flow be tardy—the glass is removed and emptied; and is then reapplied, freshly exhausted. On each reapplication, it is well to shift the glass slightly from the former site; so that the pressure of its rim may not be injuriously concentrated on one and the same circle of integument. During the intervals of reapplication, a warm sponge covers the wounds; and, on leaving, is made to rub them somewhat rudely, in order to prevent the lodgment of coagula. Detachment of the glass is effected carefully, by pressure of the finger at the uppermost part of the rim; the glass, thus loosened by entrance of the atmospheric air, is slowly bent, as it were, downwards; a sponge pressing firmly on its rising edge, so as to sweep all the blood into its interior, leaving the bed and body clothes unsoiled. The number of glasses, and of their applications, are varied according to the amount and rapidity of abstraction desired. The average product of a single glass may be held as ranging from four to six ounces.

If the glass be placed over a wound, or wounds, fed by a distinct arterial branch—such as the anterior branch of the temporal artery—the portion of the rim which overlays this vessel, on its cardiac aspect, is to be a little raised; so as to permit free arterial influx, otherwise the bleeding will prove but scanty.

Abstraction over, the parts are lightly and cleanly sponged, and covered by some simple adhesive plaster; usually they heal readily, by adhesion. But it may be desirable that they should not do so; the case may be such, as to render the early succession of counter-irritation advisable. The wounds are then treated by stimulants, so as to favor inflammation and suppuration; and the scarified part is thus speedily and easily converted into a suppurating issue.

Much ingenuity has been expended, in adapting apparatus to the performance of this operation; but all modifications have, each in their turn, been found inferior to the ordinary mode. Much practice, however, is necessary, ere the dexterity of a neat and successful manipulator can be acquired.

Leeches can be used, when and where cupping-glasses and scarificators cannot. Their application is simply effected, by confining them in a glass, or wire-gauze receptacle; which, inverted, is held steadily till they fasten on the part whence we wish the blood to issue. They are thus effectually prevented from sprawling abroad diffusedly, as their fancy would probably lead them. The part is previously made smooth by abrasion, and clean by ablution; especially if fetid or otherwise noxious matter have been formerly applied. Appetite is increased in the animals, by their being made dry; both outside and in. On this account, they should be kept for some time out of water, and be gently dried with a soft towel before application. And it is well also to surround them with cambric, the unsubstantial network of which seems to irritate them into activity. If still slow to bite, they may be briefly immersed in warmish porter; and the part may be smeared, either with sweet cream, or with blood freshly drawn from a puncture. When they have filled and loosened, the part is diligently and hotly fomented, so as to encourage oozing from the apertures; and by this the greater part of the bleeding will probably be taken. Each leech, or rather each leech-bite, may be rated at about an ounce and a half.

Sometimes the hemorrhage is troublesome, by continuance, from one or more of the apertures. Let firm, direct, dry pressure be maintained, for a short time; and this will probably be sufficient for its arrest. Or the matico leaf may be applied, along with pressure. If this fail, insert the point of a finely pencilled portion of nitrate of silver, carefully into (not on) the aperture; press steadily with it there, for a few seconds; and immediately on its removal apply a dry compress, retained by either the finger or a bandage. It is not often that this procedure is demanded; and still more rarely does it fail, when duly practised. If it should fail, however, then transfix the part by a fine needle, and encompass this firmly by a ligature; as in the formation of the "twisted suture."[1]

Troublesome bleeding is most likely to occur in children; more especially if the leeches have been applied to parts not only of active circulation, but also exposed to constant or frequent motion; as in the neck. And it is a safe general rule, applicable to leeching at a tender age—when, as we have seen, much bleeding is but ill borne—that the patient be not left, particularly eding has fairly ceased. To leech a child on the ch r the part with a large hot poultice, and to leave i urs, is to encounter a great hazard of the patient's hage.

In regard to children, e remembered, that the loss of blood by a few leeches is equivalent to ll bleeding from the arm in the adult; that in them, in short, a loca s equal to a general blood-letting. "Three leeches, bleeding well, a full bleeding for a child of one year, at least of the average strength of those brought up in great towns; and if one leech is added for each year of the child's age up to five, a fair number for a single evacuation may be obtained. Beyond this age, in strictly inflammatory cases, bleeding at the arm is certainly to be preferred."[2]

But there are other precautions to be regarded, in the application of leeches:—1. They should not be placed where there is either frequent or constant motion; as on the neck, or over the costal cartilages; otherwise, the bleeding is not unlikely to prove troublesome. 2. Nor should they be placed on parts habitually exposed, especially in females; as on the neck or face; otherwise the cicatrices may prove unseemly. And when it is remembered that local bleeding, unless in large quantity, is usually most effectual when indirectly taken from the part, we shall seldom find it difficult to fulfil the foregoing indications. 3. In children, it is well to avoid large superficial veins; especially in the neck. 4. Nor should leeches be placed where the areolar tissue is peculiarly lax and delicate, as in the eyelids; otherwise ecchymosis, acute œdema, or both, are apt to ensue. 5. Nor where subcutaneous nerves abound; otherwise much pain will be occasioned, and the occurrence of either erysipelas or angeioleucitis rendered not unlikely; in the case of the fore-arm, for example, the dorsal will be preferred to the palmar aspect. 6. They should not be placed directly on the part inflamed; for, (1.) unless in sufficient numbers to prove spoliative, their effect will not be antiphlogistic, but the contrary; (2.) because they are apt to prove irritant, and may, by adding fresh stimulus, hurry on instead of arresting the inflammatory process. In addition to the irregular form of wound, and the strain of suction, the introduction of poisonous matter from the creature's own secretions may sometimes be a cause of untoward excitement. On these accounts, leeches are properly superseded by punctures in erysipelas. 7. They should not be placed in the immediate vicinity of an acute ulcer, more especially if this be of a specific kind; otherwise the bites are apt to be inoculated, and consequently to degenerate into ulcers; so extending, instead of limiting the evil. 8. Nor should they be applied, unless considered truely indispensable, where bandaging or other retentive means are of paramount importance; as in fractures of the limbs. For, under such circumstances, the wounds are apt to inflame and ulcerate; compelling a discontinuance of the most important part of the apparatus, and perhaps at a critical time of the cure.

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[1] I think it unnecessary to notice the many other contrivances for stopping leech-bites; being satisfied that one or the other simple means, here specified, will be found in every case successful.

Blood may also be taken from a part by *Punctures;* as in simple erysipelas. *By Scarification;* as in inflammatory affections of mucous membrane—the eyelids for example. By *Incision;* as in phlegmonous erysipelas. But, in addition to abstraction of blood, these wounds perform the more important office of withdrawing the inflammatory exudation; thereby affording most valuable relief to the part; not only removing what has been already exuded, but also affording a ready exit to the coming deposit; and so saving the surrounding textures from destructive infiltration.

3. *Purgatives* are generally an important item of the antiphlogistic catalogue; and are used early. They disburden; by clearing away accumulated matter from the intestinal canal; so overcoming one of the most prominent symptoms of the inflammatory disease—constipation. And likewise, by such clearance, they favor the action of other medicines. Before bleeding, large doses will be necessary, perhaps ineffectual; after loss of blood, a much weaker purge will obtain the end desired. They deplete; by causing an increase of mucous exhalation from the lining membrane of the bowels; so assisting the direct abstraction of blood from the system. They may sometimes exert a derivant effect in favor of the part inflamed, by bringing an unusual amount of blood to the intestinal canal. They are further of use by opposing assimilation, and thereby cutting off from the circulation its nutritious supply; thus tending to maintain the wished-for depression of system. During the decline of inflammation, they are still of use—if not contra-indicated by general debility—by favoring absorption in general, and consequently hastening the disappearance of redundant deposit.

They are especially of service in affections of the head; having a marked derivant effect on the brain, as well as on the upper parts of the body in general. The pallor of the countenance which follows purgation is familiar to all; as also the lightness and giddiness of the head which are apt to ensue by continuance of its use. On the other hand, there are cases in which purgatives cannot but prove injurious; as in compound and comminuted fractures, where total absence of motion is by far the most important part of the treatment; and in inflammatory affections of the bowels themselves—when, by effecting both increased determination of blood to the affected part, and exaltation of its function, they are more calculated to cause aggravation than decline of the disease.

Purgatives are given, at first, usually of a drastic and searching nature; afterwards simple and saline. Their object being, first to evacuate thoroughly, as well as to promote copious secretion, especially from the liver; afterwards merely to keep up moderate exhalation from the mucous membrane. If need be, they may be assisted by enemata. Or these may sometimes occupy their place; when the stomach proves especially resentful of intrusion.

4. In some cases, *Emetics* are useful, at the outset; clearing the stomach, encouraging secretion from the liver, interrupting assimilation, and favoring perspiration; also as auxiliaries to expectoration, they may prove highly advantageous—as in croup. This class of remedies are of course inexpedient, when there already exists marked determination of blood to the head: the effort of vomiting would then be dangerous. On the other hand, they may be expected to prove especially beneficial, in those inflammatory affections which are preceded and accompanied by obvious biliary and stomachic derangement. In many cases of erysipelas, for example, there is no better commencement of the treatment than full and free emesis.

5. *Mercury.*—The mercurial is often the preferable form of purge at the outset of treatment—calomel, followed by jalap, for example; causing copious exhalation from the intestinal mucous membrane, promoting a free flow of bile, and—if that secretion be part of the fuel by whose intra-combustion, animal heat is maintained, as chemistry has of late hinted—obviously tending to lower the febrile increase of temperature. But it is not as a purgative that mercury is chiefly antiphlogistic; not when it passes quickly through, but when it is retained in the *primæ viæ*, is absorbed thence into the system, and lays hold of this, exerting on it a specific effect; the systemic seizure being usually indicated by fetor of the breath, tenderness of the gums, and rawness of the mouth, which, if the introduction of the mineral be continued, advances to complete salivation. But as it was not the purgation, so is it not the mere salivation which we usually desire. Mercury, gradually introduced into the system, seems to exert a tonic effect on both the extreme bloodvessels and the lymphatics, that is on exhalation and absorption: preventing or limiting impending exudation, and at the same time expediting the removal of that which has already escaped. Not merely is absorption stimulated to remove the recent and fluid deposit. The state of the deposit itself is affected. If it have been some time exuded, and somewhat advanced in organization, such progress is arrested, softening takes place, and it is rendered amenable to the increased play of absorption. Besides, mercury is supposed to act directly on the blood; affecting the red corpuscles, as well as assisting in removal of the abnormal proportion of fibrin. Affection of the gums is not of itself valuable, but only as showing that impregnation of the system by the mineral is so far advanced as to be equal to the effecting of its truly antiphlogistic results.

From its power of limiting and removing exudation, it is very plain how valuable must be the administration of mercury in all inflammatory affections of important internal organs whose functions must seriously suffer by any considerable change of structure, however temporary; and also when texture is extremely delicate—even slight exudation producing much disorder, and hard to be recovered from—as in the iris, and synovial membrane. When such parts are becoming truly inflamed, we give mercury with eagerness; desirous that its constitutional effect should be both speedy and complete. But he is a sadly thoughtless and reprehensible practitioner, who throws in mercury with a loose and careless hand for inflammatory affections in general—real or supposed; regardless of the risk thereby encountered of hopeless ruin to the system, at no very distant date. Fortunately, such risk need not be dreaded by the wary surgeon, who not only gives no mercurial course unless such be demanded, but also inquires diligently into the circumstances connected with that demand, ere he admits it to be just and true. When satisfied on this point, he hesitates no longer; but proceeds to his duty of saving vitally important texture and function, at all hazards; comforted by a belief, well-grounded on experience, that by such affections there is engendered a tolerance of mercury, both present and to come.

The best form of exhibition is calomel; usually combined with opium, in the form of a pill; two or three grains of the former with half a grain of the latter; repeated every hour, or every second, third, fourth, fifth, sixth, or tenth hour, according to the haste with which we desire to affect the system. The opium prevents the mercury being wasted as a purge, and insures its internal reception by absorption; while itself has a beneficially sedative result on both the nervous and vascular systems. In accordance with a laudable desire to obtain the constitutional effect at the least possible cost of mercury, it has lately been proposed to give calomel in very minute doses, often repeated; as the twelfth of a grain, every hour; absorption being supposed to take place very readily and fully from minute doses—as is exemplified in the internal use of arsenic. Such caution is much to be commended; and such doses are quite allowable, in cases of no great urgency, either as regards intensity of action or importance of texture involved; but the old-established and well-tried dose, as above stated, is far more trustworthy in the true inflammatory emergency. Should calomel and opium be found to disagree, a convenient substitute may be found in the hydrargyrum cum cretâ with Dover's powder. When it is desirable to affect the system with extreme rapidity, or when the ordinary mode of exhibition is peculiarly tardy, the desired result may be accelerated; by rubbing in a mercurial ointment or liniment on the inside of the thighs, in the axillæ, or over the part affected. Inunction is also of service alone, when the internal use of mercury is ill borne by the system.

Mercury, let it ever be remembered, is in most cases only subsidiary and second to bleeding as an antiphlogistic. The intensity of the inflammation must be first broken by loss of blood; and the remainder is then well dealt with by the mercury. Should the latter go single-handed to the contest, it may excite, and do harm instead of good. Not unfrequently, however, it has the greater part of the work to do, and sometimes almost unaided; as when iritis, or other serious inflammatory affection exists, while there is no tolerance of loss of blood in the system.

The time, then, at which we are to commence the exhibition of mercury, for antiphlogistic purposes, is usually after bloodletting. We desist when the gums have been "touched," as the ordinary phrase is; showing the attainment to systemic seizure. Or we may often cease from its use at a still earlier period; the symptoms which demanded it having satisfactorily given way. Should the disease, on the contrary, prove obstinate, even after affection of the mouth, the mercury may be cautiously continued, so as to maintain *ptyalism*, until recedence or change in the symptoms occur; but, in no case of mere inflammation, is full, far less sustained, *salivation* at all necessary.

In all cases, before enjoining its administration, it is well to inquire as to the existence or not of idiosyncrasy regarding it; whether the patient is easily affected, or otherwise; whether liable to the troublesome eczema, or to the dangerous erethismus.

Should mercury bot[illegible] to purge, notwithstanding combination with opium [illegible] well that the doses be given in some bulky vehicle. [illegible]y cases—as certain forms of the venereal disease—[illegible]ndencies are readily avoided by giving the mercury [illegible]e ordinary meals.

Locally, mercury is of use, [illegible] plaster or ointment applied to the part affected. But the proper ti[illegible] for its employment is still later than that of the internal exhibition [illegible] It is meet to oppose, not the disease itself, but rather its results on texture. All acuteness of disease must have been previously subdued, by the earlier and more appropriate remedies; and then mercurial inunction, by its tonic and stimulant effect on bloodvessels and absorbents, may happily restore the tone of the former, as yet dilated and weak, and prone to continuance of exudation; while it rouses absorption to an increased duty, so that deposit may be removed, and the normal condition of texture restored. But, at an earlier period, the same application, now so beneficial, could not fail by stimulating the bloodvessels to aggravate the disease and the changes of structure to which it tends.

6. *Opium* we have already seen to be of use combined with mercury; as an auxiliary towards the constitutional effect of the latter remedy, by preventing purging. Its own direct influence is also favorable. But, still more than mercury, it must follow bleeding. Given before loss of blood, it further dries up general secretion, seems to increase vascular excitement, and aggravates the inflammatory symptoms, both general and local—especially the former; not unfrequently inducing alarming delirium. Whereas, following bloodletting, the sedative effect on the circulation, which this had induced, is maintained; the general nervous system is soothed; pain in the inflamed part is assuaged; and with the combination of mercury, ipecacuanha, or antimony, secretion is not opposed. The patient, previously tossed on a sleepless couch, sinks into profound slumber, and awakes refreshed; with a soft, moist skin; and with his troubles, both local and general, wondrously abated. After severe bleeding, we have already seen how a full opiate is of much service in allaying or altogether preventing nervous reaction. But, when much blood has been lost, the dose of opium, although full, and perhaps often repeated, should always be guarded. Soothing is wished, not thorough narcotism; and, under such circumstances, the latter is not

unlikely to be induced, directly perilling existence, should the opiate be given too largely, or at too short intervals.

Narcotism may be also untowardly encountered, by repose in a common belief, that when opium is to be given by the rectum, a much larger dose is necessary than when it is administered by the mouth. The dose should be the same; certainly not greater. Its absorption is just as likely to be speedy and full, by the mucous membrane of the lower bowel, as by that of the stomach; perhaps more so; seeing that, as Dupuytren has observed, the function of digestion may interfere obstructively in the one case, but cannot in the other. It is of course, assumed that the lower bowel is free from fæculent accumulation, and that the fluid opiate is brought into direct and general contact with the lining membrane. With due precaution, the administration of opium by the rectum is a valuable substitute for its ordinary mode of exhibition; especially when there happens to be much nausea, the stomach rejecting all ingesta.

During inflammatory affections of internal parts, attended with excruciating pain—as in peritonitis—opium must be given in larger doses than usual, and oftener repeated; there is a tolerance of the remedy created by the disease; and, besides, such pain must be subdued at all hazards, otherwise it will inevitably exhaust the powers of life. Still, however, the opium must follow bleeding, not precede it.

In such cases, it may be given pure; the anodyne effect being the paramount indication. But, for ordinary antiphlogistic purposes, it is combined with mercury, antimony, or other auxiliaries; and thus is avoided the disadvantageous tendency of opposing secretion, which it is otherwise apt to evince.

In inflammatory affections of the brain or its envelopes, or when these important parts threaten to become secondarily involved, opium must be either abstained from, or given cautiously in combination; for it tends to induce determination of blood to the head. If altogether disused, its place may be occupied by conium, which has a directly opposite effect in regard to the cranial contents. If employed, let it be combined with antimony; and let it be given watchfully, with the head well raised and kept cool. Such anatomical combination is extremely useful in all cases of cerebral excitement, which we are very anxious to subdue, and against which we are afraid to employ opium alone and unmodified in its effects.

7. *Antimony* is a valuable antiphlogistic; usually given in the form of potassio-tartrate. Its effect varies according to the amount of dose. An aqueous solution, containing a sixth, or eighth of a grain, repeated every two hours, will produce diaphoresis; overcoming the arid state of the skin, relieving the capillaries by restored secretion, and undoing one of the most characteristic symptoms of inflammatory fever. If diaphoresis be especially desired, its occurrence may be facilitated by the outward application of heat and moisture.

A quarter of a grain, similarly repeated, not only proves diaphoretic, but also occasions nausea, and exerts a sedative influence on the general circulation; and that independently of previous loss of blood. Of course, it will prove a more powerfully depressing agent when bloodletting has been premised; but it is important to bear in mind, that such precedence is not so necessary to its antiphlogistic effect, as in the case of mercury and opium. From the first, it seems to diminish tonicity of the vascular system; and, consequently, in many inflammatory affections, neither themselves very intense nor seated in important parts, antimony, single-handed, may effect the desired depression; leaving the veins unimpoverished of their all-important contents.

In the dose of from half a grain to a grain, repeated every two hours, a still more truly antiphlogistic influence, resembling the mercurial, seems to be exerted; opposed to general exaggeration of arterial tone, limiting local deposit, favorable to absorption, and so tending to restore normal texture and func[illegible]ct further seems to be most distinctly shown in infla[illegible]f vascular internal organs. It may be supposed tha[illegible]ntimony is only a duplicate of mercury. But it is n[illegible]f calomel—more especially when sakelessly given—[illegible]cted, and bode evil for the future; those of antimony are only tempo[illegible]y. When, therefore, a case occurs in which either medicine may see[illegible]o be equally able to relieve the part effectually, antimony is decidedl[illegible]referable. In such circumstances, it is the superior of mercury, not its mere equivalent; giving similar benefit from its use, yet leaving no lurking danger behind. Again, both may be advisable remedies in the same disease; each employed at its own appropriate period of the case. Thus, in pneumonia, full doses of antimony are most likely to relieve in the early stage, while exudation is still soft, recent, and of more or less fluid consistence; while, at an advanced period, hepatization having been completed, greater reliance may be placed in the effect of mercury, if the constitutional symptoms have subsided. For, as formerly stated, this seems not only to favor absorption of recent and fluid deposit, but also to be capable of undoing that which is of older date, and some way advanced in organization; softening it, and so fitting it to be taken away either by absorption or by ulceration.

In this country, the doses of antimony are seldom made higher than those already specified; but, on the Continent, ten grains and more, repeated, are not unfrequently indulged in. It remains to be shown, however, whether such heroic measures are in any respects superior to the ordinary mode and amount of administration.

It is to be remembered that a certain tolerance of the remedy is doubtless engendered by the inflammatory process. And, consequently, the patient is to be warned that though the first dose or two may induce nausea, and even full vomiting, he is not to be discouraged thereby; but to persevere, as the sickness will soon and certainly cease. When tolerance is suspected to be incomplete, however, or when it is especially desirable that no actual emesis should occur, a few drops of laudanum, or of the solution of the muriate of morphia, may be given with each of the two or three first doses of the antimony; or these may be combined with a few drops of hydrocyanic acid.

The happy effects of a combination of antimony with opium, in cases of disorder of the cerebral functions—without inflammatory disease within the cranium, yet with a suspected tendency thereto—have been

Aconite is a powerful antiphlogistic. It tends to relieve, by cutaneous and other secretions. But its most important effect is to lower the heart's action and general circulation. In this respect, indeed, it is perhaps the most simple and yet the most powerful of sedatives. Large doses are anodyne, and anti-neuralgic (p. 71); but they are unsafe, and require great watchfulness; and, antiphlogistically, they are unnecessary. Small doses—such as half a drop, or a quarter of a drop, of the strong tincture,[1] in aqueous solution, repeated every hour, every half hour, or every two hours—are quite safe, and are truly antiphlogistic. Often, under their use, the pulse will be found to come down even rapidly; the other febrile symptoms at the same time giving way.

Aconite, probably, has not the same powerful influence on the part affected, as antimony or mercury; but it may well take the place of either, in dealing with inflammatory fever, when structural change has not advanced, and when—as in common external affections—the texture involved is not important.

Belladonna, too, is anodyne and antiphlogistic; and, as such, may be given in small doses. As an opponent of erysipelas, it enjoys a considerable reputation.

9. *Colchicum*, also inducing a sedative effect on the circulation, and tending to cause increased exhalation from the mucous membrane of the bowels, as well as very marked increase of secretion from both the liver and the kidneys, is plainly qualified to prove highly available as an antiphlogistic. In full doses, continued, it is supposed to exert a specific effect on the part; freeing it from impending change of structure, as do mercury and antimony. Being further endowed with the property of eliminating urea from the system, by its agency on the kidneys, it is especially appropriate to inflammatory affections of a rheumatic origin and character (p. 62). The wine of the seeds, cautiously commenced, and steadily increased, is the favorite form of remedy.

Diuretics in general, by their evacuant effect, may be classed among the not unimportant antiphlogistics; especially their simplest forms: nitrate of potass, bitartrate of potass, sweet spirits of nitre, acid and alkaline drinks, &c. They of course are exceptionable, when the secreting organ, the kidney, happens to be the seat of the inflammatory disorder; for, by their use under such circumstances, the paramount indication of obtaining rest, actual or comparative, for the affected part, would be most palpably contravened.

Saline medicines—the carbonates of potass and soda, nitrate of potass, sulphate of soda, tartrate of potass and soda, bitartrate of potass, &c.—are useful as cooling draughts, promoters of perspiration, diuretics, and adjuvants to secretion from the intestinal mucous membrane; and, besides, they are supposed, not without reason, to exert a special action on the blood. In consequence of the solvent power which they possess over fibrin, when taken internally they may affect salutarily the abnormal amount of that constituent in inflammatory blood; and "they may prevent or destroy the aggregation of the corpuscles, and consequently their tendency to separate from the fibrin and to accumulate in the minute vessels."[1]

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[1] This preparation not being Pharmacopœal, the formula is subjoined from Dr. Fleming's Monograph (Fleming on Aconite: Edinburgh, 1845, p. 80)—"*Tinctura Aconiti:* Take of root of A. Napellus, carefully dried and finely powdered, sixteen ounces troy; rectified spirit, sixteen fluid ounces; macerate for four days; then pack into percolator; add rectified spirit until twenty-four ounces of tincture are obtained. It is beautifully transparent, of the color of sherry wine, and the taste is slightly bitter."

In this way, for example, the good effects of large and continued doses of nitre in acute rheumatism may be accounted for; the excess of fibrin, with tendency to formation of the buffy coat in blood extracted, being peculiarly manifested in that affection (p. 62).

10. *Antiphlogistic Regimen* is not the least essential part of the treatment. It comprehends, 1.—*Diet.* This is to be given but sparingly, and invariably of a non-nutritious character, so long as the action remains unbroken; and, even th[illegible] generous food must be most gradual and cautious. [illegible] ppetite and loathing of food are tolerably prominent [illegible] atory progress; it is during the period of decline tha[illegible] ssary, in denying the returning appetite, or deceivin[illegible] materials. A hearty meal, untimeously indulged in, has often reindu[illegible]ed all the mischief. Drink should be bland, simple, and cooling; gi[illegible] often and in small quantities, rather than in copious draughts; for [illegible]e latter, unless productive of diaphoresis or diuresis, may prove injurious rather than beneficial. Thirst, however, is usually a most troublesome symptom of inflammatory fever; and must be assuaged, with due precaution. Acidulous drinks are usually the most refreshing; and of these it is well to have some variety, as the most palatable is apt to become distasteful after a time. Dilute solution of nitrate of potass, and of the alkalies combined with vegetable acids, are not only grateful to the parched mouth, but likewise relieve the fevered system by favoring secretion—therefore not unjustly termed Refrigerants. And, besides, we have just seen that they may play an important part, as correctives of the blood. 2.—*Rest* of the body, with *quietude* of mind, is plainly an important indication, and ought to be fulfilled so far as circumstances will permit. Restlessness and jactitation are symptoms of the constitutional disorder, as also tendency to apprehension, anxiety, and general disquietude of mind; and consequently are to a certain extent inevitable. The general antiphlogistic management, by removing their cause, is the most effectual means of removing them; but, some time is necessary for this; and, in the meanwhile, much may be done by many little attentions on the part of the attendants. 3.—*Air.* When it is remembered how essential is a free supply of good air to the maintenance of a healthy state of the blood, and how imperfect aeration leads to obstruction of the capillaries, systemic as well as pulmonary, the necessity for due ventilation of the sick-chamber becomes very apparent, during the progress of inflammatory disorder—a process so intimately concerned with the capillaries and their contents.

Local Treatment.

1. *Rest.* To procure as complete rest of the inflaming part as circumstances will possibly permit, should be the first care of the surgeon; and to maintain it undisturbed, his efforts should be directed throughout the

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[1] Hewson's Works, edited by Gulliver, Lond., 1846 (Sydenham Society), p. 41.

whole period of treatment. Thus he avails himself of an important advantage which he has over the physician. In surgical inflammatory affections, of external parts, this valuable indication may be often completely fulfilled; while it can only be effected partially, if at all, in the case of an internal organ—as the heart, lungs, or kidney. Place an inflaming joint in a state of rest, so soon as you are called; maintain its immunity from motion undisturbed, by splints or otherwise; and you will not require to take largely from the rest of the antiphlogistic catalogue. Whereas, permit its play, voluntary and involuntary, to remain uncontrolled; and leeches, cuppings, blisters, time, may be all freely expended, without securing an equally satisfactory result. The same parallel may be drawn in regard to every part truly inflamed.

2. *Position.*—Not only should the part be put and kept at rest; it should also be placed and maintained in such a position as to favor the antiphlogistic result. The knee, for instance, is bent; so as to relax the muscles implicated; thereby relieving tension, and diminishing the risk of involuntary spasmodic movement. At the same time, the limb is elevated; in order to favor venous return, and retard the arterial influx.

The inflaming part having been thus attended to, as regards both rest and posture, we are in a favorable position for proceeding to local blood-letting; in the manner, and on the principles already detailed.

3. *Cold.*—With some it is still an unsettled point, whether heat or cold be the preferable application to an inflaming part; the question being usually left open, to be determined either by chance or by the feelings of the patient. Heat and cold are both valuable antiphlogistics; but each has its appropriate period for use; and either, employed out of its own proper time and place, will generally do harm. The virtue of cold is chiefly as a prophylactic; diligently and carefully employed during the period of incubation. Thus, after the infliction of an incised wound, we are anxious to prevent inflammatory access, or at least to retard and limit its invasion; and, with this view, we have recourse to the continued application of cold, in the manner formerly described (p. 134). Should we succeed in averting the inflammatory process altogether, we gradually cease from the application. Should the inflammatory process fairly set in, notwithstanding our efforts to the contrary, it is equally our duty to desist; the time appropriate for cold has passed, and if its use be persevered in, harm will follow. It then opposes exudation; and so prevents the natural relief of the overburdened vessels. It promotes contraction of the parenchyma; rendering this less yielding, than it would otherwise be, to the exudation which does occur; and so it favors tension and consequent aggravation. And, during further progress of the disease, it must, by its directly sedative influence, depress vital power in the part; so favoring the supremacy of action over power, and hurrying on the former to its extreme results—suppuration, ulceration, and gangrene. During the progress of inflammation, it may induce, or seem to induce, abatement of one symptom—the heat; it may also, by its sedative action, assuage the perverted function of the nerves; but, in all other respects, the part can scarcely fail to sustain injury by it. During incubation, be diligent in its application; but desist so soon as the signs of inflammatory accession have become apparent.

Another precaution is necessary. Let not the cessation be abrupt, but gradual; from cold to cool, from cool to tepid, from tepid to warm, from warm to hot; otherwise, the second or reactive effect of cold, intensely favorable to vascular change, is inevitably produced. During the use of cold, it is its first or sedative effect which we desire to maintain. And when departing from this, its fitting time having elapsed, we should beware of inducing the second effect; which may, of itself, originate perverted vascular function, and is certain to accelerate advance if already begun—more especially should the power of the part happen to be even temporarily depressed.

When disease has fully subsided, and exudation has greatly disappeared, the part still, ho ak, lax, and swollen, with its bloodvessels in a congest ;ain may become serviceable. But it is not applied w rwise, power might be still further reduced. And i a mechanical influence; in the form of *douche;* p stringent effect on the part, somewhat stimulating absorption, and im arting tone to both bloodvessels and parenchyma.

Cold thus is found to be of use, at both xtremes of the inflammatory process; just before its accession, and subsequently to thorough recession. But, during the actual existence of inflammation it is inapplicable.

4. *Heat and Moisture,* plainly less suitable than continuous cold during incubation, are as plainly preferable during inflammatory progress. They are grateful to the feelings of the patient; allaying the sensations of pain, heat, and tightness. They favor exudation from the vessels; whereby natural relief is given to the oppressed local circulation. They at the same time relax, and promote yielding of the parenchyma, to receive the exudation accommodatingly. The vessels are relieved; and yet texture is not incommoded; there is no tension, and, consequently, no increase of throbbing and pain, with aggravation of the disorder. Also by relaxation of both bloodvessels and parenchyma, combined with relief of the former by exudation, the stagnating tendency of the blood is opposed, and renewal of the circulation favored.

It is very obvious how thus heat and moisture tend to a favorable result during the crescent process; but it is equally clear that, at a subsequent period, during the decline, their use cannot be continued without disadvantage. For, the acute change over, and its results remaining, that which tends to maintain exudation, the dilated condition of the vessels, and relaxation of the surrounding parts, is opposed to resolution, and positively injurious. Let the application, then, be diligently employed during the active stage, and gradually abstained from so soon as the process of decline has been fairly established. There is little doubt that protracted chronic disease, with tedious suppuration, is often attributable solely to injudicious continuance of poultices and fomentation.

The form of application may be either that of Epithem or Fomentation. The latter is more generally available. A piece of flannel, or sponge, wrung out of hot water, is applied as warm as can be conveniently borne, and replaced by a substitute so soon as the heat begins sensibly to abate. This is continued for half an hour, or more; and is repeated at longer or shorter intervals, as circumstances may seem to demand; the part being in the meanwhile covered by a poultice, or, after having been softly dried, protected by some simple investment—as a piece of linen, wadding, or fine flannel.

It is well, sometimes, to medicate the fomentation. Chamomile flowers, with heads of poppy, for instance, may be put into a flannel bag; and this may be used instead of the common flannel or sponge. The patient may be inclined to place more faith in such a fotus, than in mere hot water; but, besides, positive benefit is also derivable from the anodyne qualities of the medication.

When perverted vascular function is on the surface, and attended with much pain and increase of sensibility, warmth and moisture may be still further medicated. Thus, in some forms of erythema, and especially in inflammatory affection of the superficial lymphatics, much relief is obtained by keeping the part constantly moistened with a solution of acetate of lead and opium; in the proportion of two grains of each to the ounce of water. A sedative and anodyne effect is thus superadded to the ordinary tendency of fomentation. If necessary, the proportion of opium may be increased.

The form of epithem is sometimes inapplicable; the part being wholly intolerant of weight and pressure; as in acute affections of the eye. But when moderate weight is not objectionable, and the continued application of heat and moisture is desired, the ordinary poultice is very grateful in many cases; made light and soft; free from grease, and all irritants, actual or possible; and renewed as often as maintenance of sufficient temperature requires. Nothing is more suitable for an inflamed ulcer, for a forming boil or abscess, or for a sloughing bruise. There are many cases, on the other hand, in which it may be well superseded, by a more elegant and convenient substitute—lint, folded double, or quadruple; dipped in warm water; laid on the part; and covered by a larger piece of oiled silk, which retains the heat and moisture, and prevents soiling of bed and body linen. In ordinary inflaming wounds, for example, this is infinitely the preferable form of application; more easily obtained and renewed than the common poultice; less odorous; less heavy and cumbrous; less apt to irritate by degeneration. Or the texture which is now manufactured for the purpose, and termed *epithem*, or *spongio-piline*, may be employed. Or in another way heat and moisture may be used; in the form of steam, as recommended by Dr. Macartney. It may be applied by means of an ordinary vessel; or, what is better, a special apparatus such as recommended by the Doctor may be employed. A lamp, acting on a small tin vessel filled with water, generates steam. And this is conveyed directly to the part, through a woollen hose; twelve inches in diameter; kept open by elastic hoops; and about three feet in length, to prevent scalding. Perhaps the only objection to this form of application is, that the suitable means and appliances may often not be at hand; while hot water and flannel, for ordinary fomentation, can always be obtained, even on short notice.

5. *Nitrate of Silver* has two modes of action; according to the severity of its application. 1. When passed lightly, in the solid form,

over an inflaming part previously moistened, the surface, if subsequently exposed to atmospheric influence, becomes black, dry, and hardened; and the same result may be obtained by the use of a strong solution. At the same time, a mitigation of the ordinary symptoms of the inflammatory process is almost invariably evinced; if the disease be neither very active nor advanced, and situated not deeper than the true skin. In simple erythema of the fingers, for instance, often nothing more is requisite, except local rest and constitutional care, to achieve speedy and satisfactory resolution. The effect is plainly sedative and antiphlogistic; acting directly on the part. But the *modus operandi* seems to be as yet shrouded in mystery. The blackened and otherwise altered epidermis, doub[illegible] effective protection to the tender dermis, from atm[illegible]nd other external stimuli; and thus one important [illegible] The rest we cannot trace; yet we are not the less [illegible]ves of the fact—undoubted, though but imperfectly a[illegible] nitrate of silver, thus lightly used, has a purely antiphlogistic effect on inflammatory affections of a slight and superficial kind.

Iodine, in solution, pencilled frequently [illegible]n the part, exerts a somewhat similar influence. But, on the whole, it is probably inferior to the nitrate of silver, as a direct local antiphlogistic; although it may be, under some circumstances, a very convenient substitute. In red, painful swellings of the toes, for instance, often associated with irritable corns; and in similar affections of the skin at the roots of the finger-nails, so common in washer-women—the external use of iodine seldom leaves anything to be desired.

Light use of the nitrate of silver may be also rendered available, in circumscribing perverted vascular function, when superficial and disposed to spread—as in erythema and simple erysipelas. It is applied in substance to the sound skin, about two inches from the erythematous border; so as to form a belt, of about an inch in breadth, surrounding the extending redness on all sides; or opposing it only on that side towards which we particularly wish the disease should not spread. In very many cases—other suitable means being, of course, not neglected—the disease advances up to this line of circumvallation; and, failing to surmount it, becomes arrested within its confines. Care must be taken, however, not to produce vesication by too severe an application; otherwise, the effect will probably be to hurry on extension of the redness, and to favor its transgression of the limits which were intended to fix its arrest.

2. Nitrate of silver may be applied, firmly and long enough to produce vesication. An excellent means of counter-irritation; but plainly inapplicable to affections of the very surface; as to them it must prove a direct rather than a counter-irritant. The milder form of application cannot be employed too immediately, as regards both time and space; indeed, the earlier and more direct its use, the more likely it is to prove successful—its effects being at once sedative and antiphlogistic. The higher dose, however, effects a plainly contrary result; as the occurrence of vesication abundantly testifies.

6. *Pressure*, like cold, may be considered rather as a prophylactic,

than as a curative agent in inflammatory affections; if employed early and carefully. Yet even then the result is problematical. It is quite possible that very gentle, accurate, and uniform pressure may be made on a part about to be inflamed, so as to prevent the first step of the process—determination of blood; or, even when that has occurred, it may prevent the second—dilatation and distension of the capillaries; and thus the establishment of the process may be, as it were, mechanically obstructed. But it is much more easy to imagine, that pressure is not so skilfully and successfully conducted; that determination to and subsequent distension of the capillaries do take place, at least in part; that the inflammatory process does begin, prophylaxis having failed to be complete; and that continuance of the pressure then can only occasion evil, by creating much tension, and so greatly aggravating the disorder.

During the progress of acute inflammation, pressure, however uniformly applied, must prove even more injurious than cold applications; and for similar reasons.

The time for the right employment of pressure is after declension of the disease; change of structure only remaining, by reason of resolution being as yet incomplete. Then, it is one of our most valued and efficient means of stimulating absorption, and so removing deposit. Yet, even then, its use must be at first cautious; lest it should over-stimulate the bloodvessels as well, and induce inflammatory reaccession. It is applied by means of plaster, splints, special compresses, or simple bandaging.

7. *Counter-irritation*, likewise, is not to be employed, until all acute disease has fully subsided. During advance of the inflammatory process, as yet unbroken by the suitable means, the induction of a new excitement by a new stimulus, even at some distance, not only fails to afford relief, but usually aggravates both the local and general disorder. The question of *time*, therefore, is an important consideration. Counter-irritation is the opponent not of acute but of chronic disease; and is also useful in getting rid of the results of either. *Site*, too, is important. Applied to the part itself, acute disease is induced therein; an occurrence invariably untoward, unless when we wish for either destruction or thorough change of structure. And a somewhat similar result is likely to ensue, if the application be made in the immediate vicinity of the part affected. To be beneficial, and even safe, the excitement artificially induced must be at some distance from the site of the original disorder; and yet not too far removed, otherwise the derivant effect it is intended to produce may fail to operate sufficiently in the right quarter. There is no more valuable remedial agent than counter-irritation; none more frequently employed, with the best results; but it must be rightly placed and timed; not too soon, not too near, nor yet too far away.

Remembering what was formerly stated in regard to metastasis (p. 116), we can readily understand the mode whereby counter-irritation acts beneficially on an inflaming part. The effect of the new excitement is to remove, or at least to diminish, the old. Marked derivation is produced (p. 139). Blood passes from the original to the recent quarter of excitement and determination; the skin, comparatively unimportant, as a texture, undergoes a slight and manageable amount of the inflammatory process; the deep part, comparatively important, is thereby relieved more or less effectually from what endangered both texture and function. The relief is analogous to that effected by local bloodletting; less powerful at the time, but, by continuance, ultimately more effectual; not directly sedative to the system, as well as to the part, and therefore capable of being continued with all propriety. Both remedies take blood from the seat of disorder; but, by the latter means, spoliation of the system attends on derivation from the part. By the higher grades of counter-irritation a certain loss is also sustained, in the form of serum, liquor sanguinis, or pus [illegible] atively trifling, and capable of being borne with imp[illegible] r be remembered, however, that induction of the ex[illegible] affection is likely to prove directly irritant to the [illegible] cially if that be peculiarly susceptible of impressio[illegible] irritable habit—during persistence of acute inflammatory fever, as well as directly irritant to the part, during the existence of acute local inflammation. In the former case, the febrile disorder receives a fresh exciting cause, and obeys it. In the latter case, inflammation being yet unbroken in the part, the stagnant and sluggish blood cannot be roused to effective derivation; the circulation must first be restored to freedom; and the part is not bettered by having to sustain two coexistent inflammatory processes, at but a little distance apart—not unlikely to unite their forces, and conjointly to tend further towards evil.

Counter-irritation may be varied in grade, form, and mode of application. 1. *Rubefacients* constitute the slightest class; and are simple counter-irritants. They induce hyperemia in an external part, and are thereby of use to relieve a somewhat similar condition elsewhere; they bring blood to the surface, but do not thence discharge it; it still remains within the general circulation. Moderate heat, mustard, and various stimulating embrocations, may be noticed as familiar examples. Of these, the mustard is probably the most frequently employed; in the form of epithem—termed a sinapism, or mustard poultice; made by spreading, within the folds of fine flannel or muslin, a thick layer of mustard flour, beat up into a pasty consistence with vinegar,[1] and moistened and warmed before application. It is kept on until redness is fully established in the skin; and, for this purpose, no definite period can be assigned, as there are many individual peculiarities in this respect. Some patients retain such applications for several hours, with comparative impunity; while to others they are almost wholly intolerable, by reason of their proving acutely irritant, both locally and generally. In children, the time of their application should be invariably brief; otherwise, they are apt to vesicate, proving more than mere counter-irritants; and may induce even gangrene, when imprudently or negligently employed.

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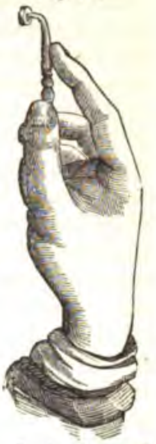
[1] The chemist says that vinegar is no good solvent of the active principle of the mustard; but experience assures us that it makes a most efficient sinapism. Perhaps the vinegar itself proves irritant.

An excellent rubefacient has been brought into use by Dr. Corrigan; and may be termed a minor cautery. "A thick iron wire shank, of about two inches long, is inserted in a small wooden handle; having on its extremity, which is slightly curved, a disk or button of iron, a quarter of an inch thick, and half an inch in diameter—the whole instrument being only about six inches in length. The face of the disk for application is quite flat." A small brass spirit-lamp having been lit, the button is held over the flame; "keeping the forefinger of the hand holding the instrument, at the distance of about half an inch from the button. As soon as the finger feels uncomfortably hot, the instrument is ready for use; and the time required for heating it to this degree, is only about a quarter of a minute." It is applied as quickly as possible; "the skin being tapped successively, at intervals of half an inch, over the whole affected part; always taking care to bring the flat surface of the disk fairly in contact with the skin. . . . . In the course of a quarter of an hour, or sometimes of a very few minutes, the whole skin becomes of a bright red, and the patient feels a glow of heat over the part."[1]

Fig. 24.



Corrigan's small cautery, for rubefacient counter-irritation; shown in the act of use.

The simple counter-irritants are adapted to the milder and less advanced examples of the inflammatory process. Active congestions, for instance, in the throat and air-passages, often yield readily to such measures when preceded by leeching and other antiphlogistics. Or the antiphlogistics may be with safety omitted, when the process is just only begun; no stagnation of the local circulation being as yet indicated, the derivant effect may be instant and complete—at once relieving the threatened texture. Not a few sore throats are daily aborted by the common sinapism; assisted, perhaps only by a purge, a sweat, and temporary starvation. As a general rule, however, it is not the less to be inculcated—in regard to the higher grades of the process, and most especially in regard to true inflammation—that even the simplest class of counter-irritants are not to be employed, until a comparatively late period; when all activity of morbid change has been fairly subdued, by other and more suitable means. Nor should they ever be used without much caution, in either children or adults of a peculiarly irritable habit; for, in the latter, they are apt to have a constitutional effect, the reverse of antiphlogistic; and, in the former, it is possible that the cure may prove worse than the disease.

Dry cupping may be ranked among the simple counter-irritants; that is, the glasses being applied in the ordinary way, but without the use of the scarificator. Blood is brought to the surface and there retained, during the application, and for some time afterwards; and the effect is obviously derivant. It possesses one advantage important in irritable habits; namely, that the desired result is at once obtained without antecedent excitement, and is independent of perverted vascular function. As already stated, it has a second advantage, in common with other forms of Hemostasis, in deriving and retaining blood from the affected part, while yet that blood is preserved within the system.

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[1] Dublin Hospital Gazette, 1st March, 1846.

2. *Vesicants* both counter-irritate and prove evacuant; not only bringing blood to the surface, but also discharging thence more or less of its thinner part—at first serous, afterwards resembling the ordinary liquor sanguinis. Heat of considerable intensity; the minor cautery, applied slowly and firmly; ammonia; cantharides, in the various forms of blistering paper, tissue, and liquid; nitrate of silver rubbed hard on the part, till pain is felt, till the roots of the hairs look blue, and till the general color of the skin begins to change—are familiar examples. They are a more powerful class than the rubefacients; and, consequently, are adapted to oppose a l[illegible]ease. Their efficacy is especially admitted, in reg[illegible]bjugation of inflammatory affections of the serous [illegible]ranes. Often, under their use, the embers of acute [illegible] extinguished; and exudation speedily disappears. [illegible]ey stimulate absorption, as well as relieve from all remaining perverted [illegible]ascular function; or it may be that, by fulfilling only the latter indica[illegible]on, the liberated texture is enabled to resume its normal function, and [illegible] work out its own cure; or the counter-irritant, establishing a brisker circulation in the vicinity of the part, may expedite disappearance of the exudation, by absorption of the more fluid portion into the increased venous return. The simple form of the cantharides is apt to irritate the kidneys; as evinced by strangury, sometimes severe. In affections of the genito-urinary system, therefore—more especially of the secerning glands themselves—we either prefer another vesicant, such as the nitrate of silver, or employ the cantharides with much caution; giving bland mucilaginous drinks, and using one of the "telæ vesicatoriæ," rather than the ordinary plaster. These profess to avoid this casualty, and often keep their promise. If very rapid vesication be desired, ammonia in a concentrated form or boiling water, or a smooth iron surface removed suddenly from boiling water, may be employed; or the part may be covered with alcoholic fluid, which is then set on fire.

3. *Pyogenic counter-irritants, or Suppurants*, prove still more highly evacuant; by establishing, from the artificially inflamed surface, a more or less copious discharge of pus; that is, of the most important part of the blood for nutritive purposes, whether normal or perverted—its liquor sanguinis. An ordinary *blister* may be converted into this class. At first, it discharges serum. This becomes less in quantity, and of greater consistence, containing a certain amount of fibrin; and at length it dries up, the part recovering with desquamation. The inflammatory process has passed gradually away. But should this be continued, either by re-application of the same cause, or by the use of some other irritant—as tartar emetic, or savine ointment—the serous discharge is succeeded by a purulent secretion, true inflammation having been reached; and such purulent discharge may be maintained, by continuance of the stimulating dressing. But when we deem it expedient to employ this higher grade of counter-irritation, it is usually our object to obtain discharge of pus from the first.

Tartar Emetic—already found so useful at an earlier period of the disorder, when given internally—is also of service as a local application; in the form either of ointment or of strong solution. Pustules form, more or less abundantly; usually of large size, and attended with a great amount of inflammation. But this application, though capable of producing much counter-irritation, has its disadvantages. The pustules do not always appear in the place rubbed, and where they are wished; but often at some distance, doing no good, and creating a great deal of unnecessary irritation; in the axilla, for instance, instead of on the arm or side. They are apt to be scattered over a large extent of surface; not concentrating the counter-irritant effect; and, consequently, comparatively inefficient on the seat of disease. Besides, the excitement induced is apt to prove excessive; the pustules enlarge, by acute inflammation; sloughing may occur, and extend; and, in consequence, the counter-irritant local effect may be merged in general excitement—an event not atoned for by absorption of the antimonial into the system. In most cases, therefore, we prefer a more mild and manageable agent.

Croton Oil, pure, or diluted with some simple oil, and colored to prevent mistake, produces a very copious eruption of minute pustules, which cluster closely together, and almost invariably limit themselves to the part rubbed; and its effects may be varied, from mild to grave, according to the intensity and duration of its use. *Nitrate of Silver*, too, in addition to its simple antiphlogistic and vesicant effects, may be made of pyogenic virtue; an ointment, containing ten grains to the ounce of lard, being rubbed upon the part. Pustules follow, of a manageable and efficient kind. And this application is said to be very useful, in the more chronic affections of the synovial apparatus of joints.

A *Seton* affords a more copious and constant supply of purulent matter, than do any of the pustular agents. It consists of a wound, chiefly subintegumental; kept open and discharging, by the presence of a foreign body lodged in its track. The integuments are pinched up, and transfixed by a bistoury; or by a broad needle, made for the purpose. To the eye of the needle, or to the eye of an ordinary probe which is made to follow withdrawal of the bistoury, a ligature is attached; to the ligature is connected a skein of silk or cotton, intended to lodge in the wound; by the passing of the ligature, lodgment of the skein is effected; and, by securing the ends in a knot, it is retained. Poultices and fomentation are applied, during the first few days, until the inflammatory stage has in a great measure passed by, and free suppuration been established; then tepid water dressing, protected by oiled silk, will prove a convenient substitute. The foreign body is moved once or twice a-day; so as to favor cleanliness, by preventing lodgment of discharge; and, by irritating, to keep up a sufficient inflammation for the discharge's maintenance. If an increased amount of excitement and discharge be desired, the foreign substance may be smeared with some stimulating ointment, or soaked in some acrid fluid, before replacement after the cleansing manipulations.

But instead of the skein of silk or cotton, it is in general much better to employ a caoutchouc tape; which is to be had, manufactured for this purpose, of various dimensions. By absorbing no discharge, it greatly favors cleanliness and absence of unpleasant odor; and, besides, remains long entire, and does not require the painful process of renewal. It is moved to a side once or twice a day, wiped, and simply replaced. The necessity for discharge, evacuant and derivant, diminishing, the size of the seton-tape is made proportionally to decrease; ultimately the last thin shred is altogether withdrawn, and its bed encouraged to close.

Sometimes, in the case of large setons of old standing, a clump of red, vascular, angry-looking granulations form, at one or other extremity of the suppurating track; giving the patient much annoyance, by pain and irritation; and sometimes emitting a considerable quantity of florid blood. They are readily got rid of, without removing the seton, by the stroke of a knife or scissors; or by the application of a powerful escharotic, as the *potassa fusa*.

An *Issue* may be established, nife or by an escharotic. In the former case, it differs fro being an open instead of a subintegumental wound. An ade; and, to prevent its healing, and insure its degener ppurating sore, a foreign body, such as a pea, is placed margins, and retained by plaster or bandage; the foreign matter urse varying in bulk, according to the extent of the wound, and the amount of inflammation with evacuation desired. When an escharotic is used, it may be either potential or actual; the former is the more generally employed; and the *potassa fusa* is, on the whole, the m suitable. It may be rubbed steadily on the part, until destruction xture is effected to the desired extent. Or a portion is laid upon the part, and retained by plaster; which, at the same time, is made to protect the surrounding integument which we wish to leave uninjured. Or a slight incision is made; and into that is inserted a portion of paste, composed of equal parts of the potass and quick lime. In any way, an eschar or slough is formed; it separates, by inflammation and ulceration; and a suppurating sore is exposed, on its detachment. This sore may be kept discharging, by stimulating applications; either constantly, or occasionally employed. Or it may be permitted to heal of its own accord; reapplication of the caustic, in the same or another part, being subsequently made, if necessary. During separation of the slough, a poultice is applied; afterwards, the water dressing. If healing is to be opposed, some irritant ointment is employed; such as the Unguentum Tartratis Antimonii, or the Unguentum Sabinæ. When we wish the evacuant effect, chiefly, we keep the original issue permanently discharging; as in many chronic affections of deeply-seated soft parts. When we desire to mingle active counter-irritation with copious evacuation—as in ulceration of the articulating hard tissues—we prefer a succession of eschars; bringing repeated inflammatory accessions externally, as well as maintaining purulent discharge.

The *Actual Cautery* stands highest in the list of evacuant counter-irritants. In former times, it was in much request by the practical surgeon; forming an invariable part of his armamentarium in daily use; and, at the hospital visit, uniformly found glowing in the furnace, ready for the performance of its accustomed function. But, nowadays, it is often supplanted, happily and humanely, by milder and not less effectual means. For hemostatic purposes, the ligature takes its place; for removal of suspected parts, the knife is preferred; it is seldom applied, with any view, to the hard textures; for the establishment of caustic issues, in the soft parts, it often and justly gives way to its potential substitute. The heated iron was no inappropriate badge of the dark days of our art; and it might well lead to boding despondency, in most of us, to find its indiscriminate and frequent use threatening to return. Still, on the other hand, let us not shrink from its employment, cruel and barbarous though it seem, in those cases which we know by ample experience are to benefit more from that than from any other application. We should be very unwilling to depart, in any way, from the axiom, "Ad extremos morbos, extrema remedia;" we should act up to, and yet not exceed its rule.

During an advancing destruction of texture in the bones of joints—more especially if deeply seated—all other means of counter-irritation may, in the first instance at all events, give place to the actual cautery. Speedy arrest of such disease is our anxious desire, ere the change shall have proved irreparable; and we are culpable, if we do not at once employ that remedy which we know to be most available to the important end. In chronic affection of some of the internal organs, also—the kidneys, for example—a cure may be obtained by the actual cautery, after having been denied to all other means.

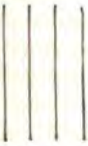
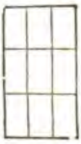
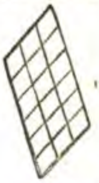
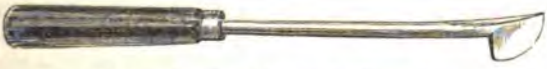
The cautery may be flat, edged, or globose. The edged form is usually preferred for the purpose of counter-irritation. It is heated to a white heat, and applied in lines to the part, to the extent deemed requisite; and the manner of such lines may be varied, according to the fancy of the practitioner—so  or so  or so [1]

Fig. 25.



The actual cautery, of its most ordinary form.

Such lines, as counter-irritants, are in all probability equally effectual as a broad continuous slough; and, on healing, leave an infinitely less formidable cicatrix. The applying hand should be heavy enough to penetrate through the entire true skin; so as to avoid the very painful burn, which would otherwise result, from exposure of the highly sensitive cutis; and it was with this view, that we specified the whiteness of the hot iron. Yet the hand should not be so heavy as to lead to the involvement of subcutaneous parts in the separation of the eschar—an unnecessary and unwarrantable sacrifice of texture. For a few hours after the cauterization, cold is continuously applied; to allay the pain, which, under any circumstances, is severe; and afterwards the eschar is covered with a tepid poultice.

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[1] Such frequent crossings, however, be it remembered, are apt to end in entire sloughing of that part of the skin.

It has been advanced by the advocates for an almost indiscriminate use of the actual cautery, in those cases which require purulent discharge from the surface, that it is doubly advantageous, and therefore superior to its potential substitute; inasmuch as, by the terror which is imparted to the patient's mind, it achieves a sedative effect on the system at large; while the pain, the inflammation, and the discharge, are more directly to relieve the part. But they forget that the use of an escharotic, in any form, for the purpose of counter-irritation, is only advisable at a comparatively advanced peri[illegible]n the expediency of a sedative result to the system [illegible]e. And, besides, we have yet to learn, that it is ev[illegible]eon's duty to strike terror into his victim; instead of [illegible]nce, and soothing his alarm and fears. Nowadays, the cau[illegible]om be applied, without the previous induction of complete anæsthesia.

The *Moxa*, once much in vogue, has latterly fallen into comparative desuetude—scarcely deserved. It consists of either a cylindrical or conical roll of porous substance, adapted for steady and gradual combustion. It may be made of the down of the artemisia latifolia—the substance originally employed; or a very convenient substitute for the Chinese original may be obtained in fine cotton wadding; carefully dried after immersion in a solution of nitrate of potass; and enveloped in tissue paper, leaving the ends free. It is held in the regular porte-moxa, or in the noose of a common wire. One end having been placed over or on the part to be cauterized, the other is set fire to; and ignition is maintained, by either the blow-pipe or bellows. According to the distance at which the burning mass is held from the part, the effect may be made to vary, from simple redness to actual eschar; and the latter may be in the same way regulated, as to both extent and depth. When applied with any degree of intensity, the pain is great, as can readily be conceived—unless anæsthesia be employed; nor is the patient's alarm and apprehension at all trifling. But one advantage certainly attends its extreme application; viz., that, after combustion is over, the pain vary rapidly subsides. The part seems to be killed so thoroughly, throughout the whole thickness of the true skin, that it is incapable of further sensation. The surrounding skin may be protected, during combustion, by wetted lint; but it seldom altogether escapes injury; and is usually the seat of tingling pain, by and by aggravated by inflammatory accession. The application of cold water immediately after the application, assists in the subsidence of pain.

By this means, very efficient and very varied counter-irritation may be effected. And it was long considered a potent remedy, in chronic affections of deep-seated joints; both of inflammatory, and of neuralgic origin. Indeed, it is not easy to understand, how latterly it should have become so much neglected; unless it be from the not unnatural disinclination, which most people may be found to possess, towards so deliberate and undisguised an application of fire to the most sensitive portion of their living frame.

The actual cautery, in whatever form applied, is doubtless a very painful and in all respects severe remedy. Long ago, it was much too frequently and indiscriminately employed, and, even in the present day, it may perhaps be found smoking in the hospital ward, oftener than necessity demands, or expediency would warrant. The cases which absolutely require its use are comparatively limited in occurrence; and for these, in the name of humanity, common sense, and propriety, let it be reserved. Also, when employing it, in cases however suitable, let it be borne in mind that such an application may not improbably prove in itself a disease of no mean importance, as regards its influence on both the system and the part; and its effects ought always to be carefully watched, with this fact in our remembrance. For example, it is a good rule in practical surgery, after having failed with this most powerful agent to arrest the progress of destruction in a joint, not at once to proceed to amputation, even should the hectic seem urgent; but to discontinue the remedy, and wait a little. Perhaps the hectic, as well as the local disorder, may happily decline; a fresh opportunity for other practice may be afforded; and, after all, the limb may be saved. In other words, the cautery, not the disease, may have been the cause of the constitutional urgency.

Stimulants and Sorbefacients.—These, being latest of application, come naturally last in the order of enumeration. Let us suppose that an intense inflammation has been first broken, by bloodletting, and by other sedatives and evacuants, and that its subsequent chronic lingerings have been effectually overcome by judicious counter-irritation. The part is found free from perverted function, chronic as well as acute, but laboring under no little change of structure, from which it is unable effectually to clear itself; or the task seeming onerous, it is, as it were, loath to begin. It is then that this last class of remedies proves highly advantageous; restoring tone to the dilated and weak capillaries, rousing the slumbering circulation to normal vigor, and stimulating absorption to an exaltation of its function—it may be, mechanically supporting the part, and preventing return of both congestion and exudation. If the inflammation have been but transient, such adventitious aid will probably not be required. The part, freed from function of a perverted kind, at once resumes its own, of the normal standard; becomes its own physician; works its own final cure. But in all cases when inflammation has been continued, inevitably causing considerable structural change, not merely is such extraneous assistance expedient; it is only by a patient continuance of its use that local health can be regained. Friction, simple or medicated; pressure, carefully regulated; plaster, with or without bandaging; iodine, in solution or ointment; mercury, in the form of either epithem or inunction—are the more common examples of this class of remedies. Their use is invariably to be deferred, until all excitement is over. They are also to be begun cautiously, and continued warily; lest at any time inflammatory accession should be reinduced. If this be threatened, they should be suspended on the instant; and ought not to be resumed until all again is quiet.

When much fluid deposit remains after cessation of inflammation, as in the serous cavities, the best sorbefacients, or promoters of absorption, are those which act upon the system and evacuate by excretion, especially purgatives and diuretics, pushed as the system will conveniently bear.

Let it not be forgotten that in all cases of true inflammation, especially the more severe, the part long—perhaps always—remains weak, both prone to reaccession of perverted function, and ill able to control or bear up against it. Therefore, such a part is to be carefully nursed, and protected from the more prominent exciting causes; and, when inflammation has recurred, we should anxiously seek for its early and complete arrest.

Now, let it not be supposed, that in each example of the inflammatory process, or even in most, [illegible] ns of the foregoing copious catalogue of antiphlogisti[illegible] yed. That were to enjoin the running of a gauntlet, [illegible] ew frames could escape unbroken. Selections are t[illegible] is in this practical department that a knowledge of [illegible] r mere theory; the practitioner tempering and guiding his theore[illegible] knowledge by experience, judgment, and discretion. It can be re[illegible] imagined, that no definite rule can be laid down on this subject, but [illegible] e following may be stated in brief illustration. There are very many surgical inflammations—as after wounds, bruises, fractures, burns, &c.—in the treatment of which none of the higher antiphlogistics are required. The internal use of antimony, or aconite, action on the bowels, local bloodletting, fomentation, rest, and attention to position, are perfectly equal to the remedial task; subduing disease satisfactorily, and yet not enfeebling, even temporarily, the general powers. When an important internal organ, however, is being inflamed—as the lungs, kidney, bladder—we are anxious to overcome the evil as soon as possible; as it were, at once to cut it down; saving both texture and function. In such circumstances, we begin with bloodletting; repeating it once and again, until the symptoms are satisfactorily subdued. When not only function of the part is important, but its texture also is delicate—the efficiency of function dependent on the integrity of that texture—as in the eye and brain, we practise bleeding with equal alacrity as in the former instance, and follow it up by the use of mercury. In some cases, full and continued doses of antimony may be substituted for the mercury. And, in some, both of these medicines may be employed; as in pneumonia; each at its appropriate period of the case. When excruciating pain attends inflammation, and more especially if the part affected be an internal organ, our principal reliance must be placed in opium, after general and local bloodletting have been pushed as far as the probably already depressed state of general vital power will permit. At all hazards, such pain must be subdued, if possible. In rheumatic inflammatory affections, opium, mercury, antimony, are, as accessaries to bloodletting, often secondary to colchicum. For the chronic embers of an acute inflammation, counter-irritation is most suitable; and this, preceded by moderate local depletion, and accompanied by complete rest of the part, is most especially effectual in the cure of perverted function which has been chronic from the first. As all vital change, whether normal or perverted, is usually slower in the hard than in the soft textures, to the chronic affections of the former counter-irritation is particularly appropriate. Again, in certain very acute affections of soft parts, we trust chiefly to the lancet and bistoury; as in erysipelas. And so might examples of the efficacy of special antiphlogistics, in opposing special forms of disease, be multiplied greatly.

The peculiarities of treatment adapted to the chronic, as contrasted with the acute form of the inflammatory process, are analogous to the differences in the nature of the two affections. In the chronic form, as the disease and its symptoms are much less urgent, so are the means of treatment less energetic and less truly antiphlogistic—less severely sedative and depleting. And, as already stated, when disease has been arrested by such mild measures, its final overthrow, followed by gradual restoration of the part to its normal condition, is to be mainly effected by judiciously conducted counter-irritation.

The student may be referred for further information on all subjects connected with the inflammatory process, its results, and treatment, to the following works:—Hunter on the Blood, Lond., 1794; Thomson on Inflammation, Lond., 1813; James on Inflammation, Lond., 1821 and 1832; Kaltenbrunner, Experimenta circa statum Sanguinis et Vasorum in Inflammatione, Monach, 1826; Travers on Constitutional Irritation, Lond., 1826 and 1835; Gendrin, Histoire Anatomique des Inflammations, Paris, 1826; Article Inflammation, Cyclopædia of Practical Medicine, vol. ii, p. 700, Lond., 1832; Alison, Outlines of Pathology, Edin., 1833; and Article Inflammation, in Library of Medicine; Macartney, Treatise on Inflammation, Lond., 1838; Canstatt, Specielle Pathologie und Therapie, Erlangen, 1841; Graves' Clinical Medicine, Dub., 1843; Watson, Lectures on Principles and Practice of Physic, Lond., 1843; Bennett on Inflammation, Edin., 1844; Travers on Inflammation, Lond., 1844; Addison, Actual Process of Nutrition, &c., Lond., 1844; Wharton Jones' Report, Brit. For. Med. Review, April, 1844, p. 567; *Ibid.* July, 1844, p. 255; see also this Journal, *passim*, according to its General Index. For the latest views, experiments, and observations, see Dr. Bennett's papers in the Monthly Journal for 1846–47; Williams, Principles of Medicine, Lond., 1848; Henle—Handbuch der Rationellen Pathologie, vol. ii, p. 405, *et seq.*, Brunswick, 1848; Mr. Paget's Lectures on Inflammation to the Royal College of Surgeons, Medical Gazette, 1850; Wharton Jones on the State of the Blood and Blood-vessels in Inflammation, Guy's Hospital Reports, Second Series, vol. vii.

CONGESTION.

Congestion is of two forms, the *Active* and *Passive*.

Active Congestion.—This has been already considered, as a part of the general inflammatory process. It may be a mere preliminary to the true inflammation; or it may persist as the minor grade, constituting a disease of itself.

Its *Causes* are identical with those of the general inflammatory process; and the *Symptoms* are such as have been already ascribed to that process, slightly developed. Redness is considerable; heat, swelling, and pain are well marked, yet not intense. Effusion and exudation are not so rapid as in true inflammation, and consequently there is little or no tension; by continuance of these, however, structure may be altered, and function seriously interfered with. More or less febrile disturbance may attend; but not of the true inflammatory type.

The *Results* also resemble those of the general inflammatory process. Resolution perhaps most frequently occurs, in the way formerly described. Or advance is made to true inflammation, and the minor process becomes merged in the greater. Or the congestion simply persists, and by continuance leads to change of structure. The effused serum contains more or less fibrin in solution; and the exuded fibrin, being of increased plasticity, threatens by organization to become permanent in its extravascular position. This may induce serious results, sadly impairing function; as in the parenchyma of an important internal organ. Or, on the contrary, the issue may be most salutary; as in the healing of wounds and ulcers, more especially by granulation.

If congestion occur suddenly, and texture be delicate as well as vascular, hemorrhage is not unlikely. If on a free surface, as mucous membrane, no harm, but benefit ensues; it is a spontaneous depletion, probably critical, and ought not to be rashly thwarted. To check such a flow prematurely may be virtually to convert, according to circumstances, hemoptysis into pneumonia or apoplexy of the lung, hematemesis into gastritis or gia into metritis; that is, preventing resolution, a nce of the disease. If in parenchyma the vessels but evil can follow such extravasation; it is by a ed.

The *Treatment* is gen Bloodletting from the part; general bloodletting, when the d is internal and important, and especially if tendency to hemo ge d extravasation be dreaded —as in the lungs; antimonials; saline pu atives; rest; fomentation; position; and the antiphlogistic re en. hould the affection threaten to become chronic, gentle counter-i s to be employed. For the morbid results, pressure, friction, a means of gently stimulating absorption, are appropriate; should ural effort of the part, when relieved from disease, not prove sufficient. But, usually, unless the congestion have been long sustained, all the serous or fluid part of the effusion is readily taken up by the spontaneous act of absorption, so soon as the active disease, which previously held absorption in abeyance, has ceased. For example, during persistence of congestion, much effusion may have taken place into a serous cavity; but by suitable antiphlogistics the congestion has been subdued; and, very shortly afterwards, the whole of that acute dropsy will probably have disappeared, without any further remedy having been employed. Thus, also, simple hydrocele is got rid of. The original chronic serous collection is removed, by tapping; stimulation is applied to the serous surface, by injection; acute effusion of serum follows, and distends the cavity again; but, on subsidence of the artificially induced affection, this serum quickly disappears; and it is seldom that any re-accumulation even threatens, a healthful balance having been established thenceforth between absorption and exhalation.

Passive Congestion.—This may follow an imperfect resolution of the Active form, as Chronic inflammation follows Acute. Or it may be original, unpreceded by excitement. In the Active form, the arteries and capillaries of the part are chiefly implicated—dilated, yet carrying on a tolerably vigorous circulation; in the Passive, the capillaries and veins are mainly concerned—dilated, but with a circulation much retarded and depressed. The redness is of a dark hue; little or no heat is complained of; a sense of weight and dulness is felt, rather than pain; effusion is gradual, and chiefly serous—consequently, with enlargement of texture we have neither tension nor induration; function is more or less disturbed. The characteristic symptoms, as contrasted with those of the acute form, are—the dark color, comparative absence of pain and heat, and soft doughy swelling gradually formed.

The *Causes* of Passive congestion may be shortly stated to be, 1, previous perverted vascular function; 2, local debility from any cause, more especially as evinced by atony of the bloodvessels; 3, obstruction to venous return; 4, alteration in the quality, and 5, in the distribution of the blood; 6, general debility. (1.) It has been already observed that the Passive form may be the consequence of the Active; the arteries having recovered their normal calibre and play, while the capillaries and veins remain distended and weak. Or the same may occur in connection with a higher grade of previous disease, the truly inflammatory; from whose vascular distension and debility, with sluggishness of circulation, recovery is less likely to prove rapid or complete. (2.) Local debility, however induced—by inflammation, exposure to continued cold, application of poison, mechanical injury—is manifestly favorable to dilatation of extreme vessels, and weakness of circulation there. (3.) Obstruction to venous return is still more plainly and directly a cause of venous accumulation. It may be the result of position; long maintenance of the erect posture, for example, tends to induce passive congestion of the lower extremities. Or there may be obstruction by compression; by ligature, by tumor, or by over-distension of a normal part. Habitual use of a tight garter will occasion passive congestion of the leg; and a similar result will follow the formation of tumor in the popliteal space or at the groin, as well as great and habitual distension of the lower bowel by fæculent matter. (4.) Diminution of the normal proportion of fibrin in the blood, retards its flow in the extreme circulation, and so favors asthenic congestion—as in simple fever, and in scrofula. (5.) Determination of blood to a part certainly produces congestion there; and if the part have been previously weak, the congestion will probably be of the passive form. Thus an internal organ, having just recovered from inflammatory disease, with its vital power depressed, and the minute vessels still large and of weak circulation, can scarcely escape passive congestion, if the patient imprudently expose himself to cold, so as to cause decided intropulsion of blood to it from the surface. (6.) General debility, bringing at once proneness to unwonted determinations, with an easy overcoming of the extreme vessels thereby, plainly favors passive congestion. (7.) It not unfrequently happens that two or more of such causes occur in unison, rendering the establishment of the morbid condition all the more certain. Thus, the patient described under the fifth head may be of either scrofulous or scorbutic constitution; and, in his case, all the causes will probably have combined, excepting perhaps direct obstruction of the venous return. And yet that need not be wanting; he may have diseased heart, impeding pulmonic circulation; or organic disease of the liver may seriously retard its venous flow—either circumstance frequently occurring as the more immediate cause of passive congestion, with its troublesome consequences, in the serous cavities.

Results.—1. Resolution may take place, and is to be hoped for; but, at best, it is a tardy process, and often incomplete. 2. Hemorrhage is not so likely to occur as in the active form; and when it does, it is of an opposite character—still passive; venous, dark colored, in a quiet slow stream; but this stream, simply by being gentle and furtive, yet constant, may lead to serious loss of blood. Its continuance can scarcely be expected to benefit the part, and it cannot fail to hurt the system, already weak and perhaps exsanguine; it may usually be arrested, therefore, with but little ceremony or precaution—a practice very different from what is applicable to a similar event in the active form. 3. Serous effusion is the characteristic result of passive congestion; occurring slowly and gradually, it may be, yet accumulating in large quantity by continuance; more aqueous, by containing much less albumen and fibrin, than the similar effusion of the active form; and most remarkably less amenable to absorption, partly because of the remaining imperfection of venous circulation, partly from the lymphatics also being depressed in function. It may take place into a serous or synovial cavity, constituting a dropsy; or into the parenchyma of a part, forming œdematous swelling. 4. Active congestion often leads on to inflammation; the passive more frequently follows than precedes. And when the latter does precede, it is only as a predisposing cause, demonstrative of local debility; favoring accession of more active disease, and also diminishing the power of resistance and control.

Treatment.—1. Manifestly the first indication of treatment is to remove the cause—whether that be ligature, feculent accumulation, unfavorable position, or structural change of some internal organ. The last mentioned is, for obvious reasons, often accomplished with difficulty, if at all; fortunately for us, however, as a cause of passive congestion it more frequently occurs in the practice of the physician than in that of the surgeon.

2. An obvious cause having been removed, it is well to disburthen somewhat the overdistended vessels, as the second step towards their reduction to a normal state. Punctures are applicable to the ordinary surface when thus affected; scarifications to mucous membrane. Serous effusion is at the same time permitted to escape, and thus the parenchyma is also relieved. In affection of deeply seated parts, however, we have to rest satisfied with less direct, and probably less efficient means of obtaining this object—a derivant, instead of a directly evacuant effect. Blood is to be coaxed from the part—not so readily as in the active form of congestion—by dry cupping, sinapisms, or others of the simply counter-irritant class; or blood may be actually drawn from the part's vicinity, in small quantity, by leeches or cupping. By either procedure—the latter the more likely perhaps—derivation is to be expected, so as to relieve, to a certain extent, the gorged and indolent vessels of the congested part.

3. The third indication—after having obtained as much relief, direct and indirect, of the part as we can—is to stimulate the bloodvessels to resumption of their wonted calibre and tone, and the absorbent system to efficient discharge of exalted function; so as to prevent further serous effusion, and remove that which has already taken place. Friction, at first gentle, and gradually increasing in vigor; pressure, uniformly ap-

plied, and also at first used gently—are obvious means of obtaining fulfilment of this indication. They may be happily combined; the one mechanically favoring retarded venous return, and indeed accelerating the general circulation of the part, the other mechanically promoting restoration of normal calibre to the bloodvessels; both vitally arousing the dormant energies of the part, as regards nutrition and absorption—more especially the latter function. Contraction of the vessels may be further favored by suitable local applications, as zinc, alum, kino, galls, catechu, &c.—especially useful when a mucous surface is the seat of the malady: also by the internal use of general tonics, as the preparations of bark and iron, the iodide of potassium, &c. The latter class of remedies will, of course, constitute a prominent remedy in those cases where marked general debility seems to have induced the local disorder, or, at all events, tends to its maintenance.

Stimuli are sometimes of use, not in procuring simple subsidence of the morbid process, but by pushing it onwards to a higher grade, whence recession is much more probable. Activity is grafted upon indolence; Passive Congestion is converted into Active. Then, abstracting the stimulus which caused the change, and employing some of the gentle antiphlogistic means suitable to the new production, resolution may be hoped for under circumstances much more auspicious. An example of this has been already quoted, as given in the modern cure of simple hydrocele. Other illustrations occur daily, in the stimulating system of treatment so successful in removing passive congestions of the conjunctiva. Care must be taken, however, that our own creation become not worse than the original malady; in other words, seeking Active Congestion only, we must avoid True Inflammation—for this, occurring in a part of weakened power by previously existing disease, is tolerably certain to advance to a result more or less disastrous to texture.

In addition to the works referred to under Inflammation, the student may consult Article Congestion, in the Cyclopædia of Practical Medicine; the same in the Dictionary of Practical Medicine; and Marshall Hall on the Effects of Loss of Blood.—Lond. 1830.

CHAPTER III.

THE HEALING PROCESS.

THE power of Nature to repair injury in the living body is the more remarkable, on account of the processes employed approaching in some cases closely in character to those which are of a destructive nature; so that whenever, by inflammation or other morbid change, a portion of tissue has been destroyed or separated from the body, either in molecules or in mass, we invariably find the slightest favorable change in the morbid process followed by the throwing out of a material adapted for filling the breach, b [illegible] ew tissue. In the removal of sloughs and the hea [illegible] he separation of mortified limbs, in necrosis of bo [illegible] me forms of scrofulous and malignant disease, this c [illegible] ative with destructive processes is constantly obse [illegible] ng as the one or the other predominates, we have t [illegible] rbance which indicates disease, or the quiet succes [illegible] ch might almost be thought normal, were it not for the [illegible] cter of lesion which called them forth, and for whose repair they are destined. Repair is usually painless, destruction painful; repair non-inflammatory, destruction highly inflammatory; repair unattended by constitutional changes, destruction marked by fever and irritation. And yet these two processes have features so closely in common, that the most minute pathological examination will often fail to detect the structural differences between them; and the transition from one to the other is by a process so gradual and imperceptible, as to baffle all attempts to define the limits of either.

In the healing, as in the inflammatory process, there is usually, if not always, an increased exudation of liquor sanguinis. But, in the former, this takes place strictly according as it is required for the formation of new tissue, or the protection of a yet tender surface; and never exceeds in quantity what is sufficient for this purpose. The powers of organization also which in inflammation are in abeyance, or much perverted, are actively employed during the healing process, in converting the exudation into permanent tissue; so that pus and other transitory structures are either not formed at all, or are only produced in such measure as is necessary for the protection of exposed parts.

The healing process may be studied under all its most important modifications, in the closing of any simple wound which occurs in a sound constitution, whether accompanied by loss of substance or not. We shall find that, under different circumstances, the injury may be repaired in the following four methods:

1. *Healing by adhesion*, or "union by the first intention;" a process independent of true inflammation, and altogether incompatible with it. For its occurrence, three things are essential. That the surfaces of the wound shall be in close and uniform contact, and be so retained; that a sufficiency of normal circulation shall be maintained in the part; and that true inflammation shall not become established. To obtain the first, surgical manipulation and adjustment are necessary; for the second, the existence of ordinary life in the part is sufficient; the third is the object of our especial care, in the management of both part and system. Liquor sanguinis is exuded in moderate quantity; its serum separates, and trickles from the wound; the fibrin remains, in the form of a thin layer investing and binding together the cut surfaces. The medium of adhesion thus formed soon developes nuclei and cells, in the same way as the fibrin of the inflammatory process (p. 118); it then becomes organized and vascularized; being converted into ordinary areolar tissue and capillaries, which are incorporated with the cut surfaces and restore their continuity. In some instances where apposition of the divided surfaces is very closely maintained, and circumstances are otherwise favorable, adhesion may occur with scarcely any trace of exudation or connecting material; the divided parts uniting simply with each other, and all trace of a wound very shortly disappearing. But, in the greater number of instances, a small amount of new texture is formed; and this is almost always, as we have said, areolar tissue, whichever of the soft textures of the body may have been involved in the wound. Thus skin, muscle, nerve, and even cartilage, when wounded, are united in the majority of instances by areolar texture; bone, however, being a remarkable exception to this law of the economy, as we shall see hereafter.

Some have supposed that blood may prove an organizable material, sufficient for adhesion; and that the presence of a coagulum, between the cut surfaces, may consequently be conducive to this result. There is good reason to believe, however, that such is not the case; that the red corpuscles, and probably the greater part of the fibrin too, constituting the coagulum, are absorbed; and that the true plastic material is the result of a new, and, as it were special exudation. The fibrin is the agent of nutrition and repair; the red corpuscles—the oxygen carriers, and supporters of animal heat—seem to be of little use but in the circulation, and minister to the function of respiration. Coagulum, when at all considerable, is a mechanical obstacle to the process of adhesion; and, under such circumstances, is to be surgically considered a foreign body—offending, and to be removed.

2. *Healing by growth;* a slow but most effectual mode of repair, analogous to the ordinary function of normal nutrition. This occurs in wounds which do not obtain coaptation of their cut surfaces, and which nevertheless do not inflame and suppurate, but retain a circulation the same as in ordinary health. A plastic exudation takes place on the surface, to a very limited extent; not for the purpose of repair, but rather to constitute a covering or protection from atmospheric influence,

exposure to which might by its stimulus hurry on vascular excitement. The surface, thus coated, assumes the appearance of mucous membrane, and distils a scanty serous secretion. Beneath, within the original textures, there advances a cellular development, as in ordinary nutrition, but at a more accelerated rate; whereby the parts slowly and imperceptibly expand, so as to efface the breach which had previously existed. There is no deposit on the outside, for filling up the gap by new structure exterior to the old; all is done within the original structure, and beneath the surface of the wound. This mode is common enough in the cold-blooded animals; and, in all the lower animals, it is of more frequent occurrence than in the human subject. Its rarity depends on the proneness to vascular excitement which we possess; more especially in a part whic [illegible] temporarily, exposed to an atmospheric influence wi [illegible] iously unacquainted. But, rare though it be, it doe [illegible] t has taken place, the most perfect, stable, and satis [illegible] reby been obtained.

3. *Healing by "the modelling process.*" This is similar to the preceding in being unaccompanied by inflammation and suppuration; different, in consisting of a deposit of plastic matter from the surface of the wound, by which the gap is more rapidly filled; portion being laid upon portion, without waste, after the manner of clay in the hands of the sculptor; and hence the term. And yet, in truth, it more closely resembles adhesion. There is a similar exudation of plastic material, from and on the cut surface; there is the same want of undue vascular excitement—just enough to afford sufficiency of plasma, and yet not interfering with the organization and vascularization of this; there is the same absence of inflammation, and of the formation of pus. And yet it differs; for the process occurs, not in a chink formed by a replaced wound, but in a gap which results from coaptation not having been effected. Again, also, comes a resemblance to the mode of repair by growth; the air must be excluded. If this exclusion be effected by Nature, it is by a pellicle or crust having been early formed. Blood, or subsequent secretion, becomes dry and concrete; adhering to the margins of the wound, and permitting merely an outward exit to the scanty aqueous discharge which comes from the modelling surface, as from that which is of mucous character and protective of the healing by growth. If by art we would induce the process, we must similarly invest the surface to the exclusion of air, either by artificially forming a crust—as by light application of the nitrate of silver—or by adapting some suitable mechanical substitute. By Collodion,[1] coagulated on the part in a thin stroma of cotton or lint, an admirable protection may be obtained; very adherent, quite impermeable, and (saving the smart of application) painless.

The preceding modes of cure are painless, or nearly so; effected by simple organization of plastic material, either within or without the cut surface; inflammation is wholly absent; there is no formation of pus; there is no waste of the plastic material, all is employed in the purposes of repair; a thin serous fluid exudes, and that in sparing quantity. Exclusion of atmospheric air, from the cut surface, is essential to them all; in the first, this is effected by accurate and constant coaptation of the wound; in the others, by a suitable investment of the part, either of natural or artificial construction.

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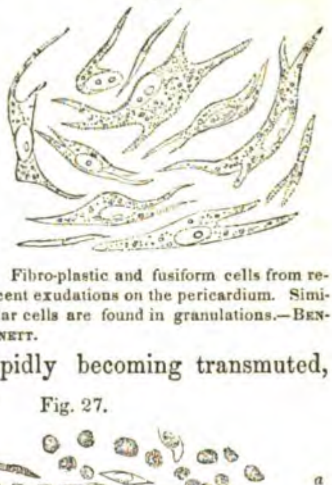
[1] A solution of gun-cotton in sulphuric ether.

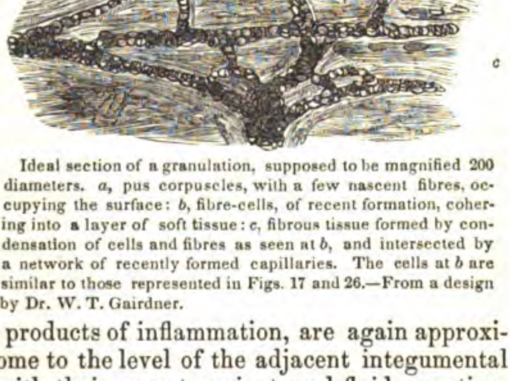
4. *Healing by Granulation*, or "union by the second intention." This is the usual mode of healing in ulcers; and also in wounds of the surface involving much loss of substance, and consequently followed by more or less inflammation. The first and most essential step towards repair, is subsidence from the true inflammatory acme. Suppuration continues, but with this difference: that whereas previously all the exuded liquor sanguinis degenerated into pus, and was extruded, its fibrin being rendered altogether aplastic by the coexistence of true inflammation, now only a part so degenerates and passes off; a plastic portion remains incorporated with and superadded to the original secreting tissue, in the form of granulations—red, fleshy, vascular, conical eminences. More liquor sanguinis is then poured out, and new granulations are formed in the surface of the old; while a certain proportion of pus continues to be produced, which serves as a protective covering to the whole. As layer after layer of granulations is thus formed, the older and deeper strata are rapidly becoming transmuted, through the influence of cells which are developed in them, into areolar tissue; becoming denser in structure, firmer and tougher, and finally acquiring vessels in the manner formerly described (p. 120); also becoming incorporated with the texture from which the exudation has taken place—and from which, indeed, it can scarcely be distinguished on section.

Fig. 26.



Fibro-plastic and fusiform cells from recent exudations on the pericardium. Similar cells are found in granulations.—BENNETT.

Fig. 27.



Ideal section of a granulation, supposed to be magnified 200 diameters. *a*, pus corpuscles, with a few nascent fibres, occupying the surface: *b*, fibre-cells, of recent formation, cohering into a layer of soft tissue: *c*, fibrous tissue formed by condensation of cells and fibres as seen at *b*, and intersected by a network of recently formed capillaries. The cells at *b* are similar to those represented in Figs. 17 and 26.—From a design by Dr. W. T. Gairdner.

After a time considerable contraction takes place in the granulations, from condensation of their texture. The edges of the wound, originally separated by their own elasticity and the products of inflammation, are again approximated. The granulations come to the level of the adjacent integumental surface; but covered only with their own transient and fluid secretion. Their permanent investment has still to be effected, by cuticular formation; that is the last part of the process of cure, and is termed *Cicatrization.*

Cicatrization is in truth the process whereby granulations, when on a level with the surrounding original skin, are permanently covered by a new integumental substance, resembling cuticle rather than true skin; but in reality composed of highly condensed areolar or fibrous tissue, including many fibres of the yellow elastic kind. The commencement of cicatrization is observed at the periphery of the granulated space, where a thin whitish pellicle is seen put forth from the original skin—which skin is usually vascularized, on purpose to sustain exaltation of the secretive function—and very slowly overspreads the raw surface; thinnest and most transparent at the margin, where of recent formation; thick and opaque where in contact and continuous with the parent tissue from which it has sprung cement of this process, the space to be invested is b ished, however, not merely by advance of the inves by actual diminution of the space itself; and this is ondensation and decrease of the newly formed substa ial absorption. It was by the deposit and organization ntinuity of texture was restored; and it is very plain that, this restored continuity remaining unbroken, diminution in the bulk of the connecting medium cannot fail to bring the original parts into near and more near apposition. But it is not to be supposed that, uniformly, this absorption of what was granulation continues until all has been removed, and that consequently the breach becomes permanently closed without the presence of new matter, merely by contraction of the old. This may happen in simple wounds which heal by granulation, when there has been no loss of substance, and when the original tissues are lax and capable of easy replacement; for, certainly, original texture is an infinitely more efficient structure than any recent imitation, however successfully organized; and, as such, will doubtless be preferred by Nature in the work of reparation. But in all ulcerations there is loss of substance; and in most ulcers there is condensation of the surrounding tissues, by fibrinous deposit; circumstances which render new formation, to a greater or less extent, quite essential not only to the temporary but also to the permanent closure of the gap.

The newly formed integument, when completed, is termed the *Cicatrix;* at first redder than the surrounding parts, thin, and tender; but gradually becoming pale, more dense, less acutely sensitive, and diminishing in extent by the process of absorption beneath, as just explained; ultimately thick and firm, not more sensible than the surrounding parts, and paler in its hue—for its permanent organization and vascularization are less perfect. In truth the new texture differs from the old, in structure as well as in appearance; the true cutis is too complicated a texture to be reproduced in a perfect form. As has been well remarked by Mr. Travers, the new formation is only a copy, and like all copies inferior to the original.

It has been stated that the new cuticular formation commences at the free margin of the old skin, and is thence gradually extended. Such is the general rule. No points of new skin spring up from the granulations, and, enlarging, gradually coalesce with the advancing marginal development. In many indolent superficial ulcers, especially when these are the result of burns, there is a semblance of this; but only a semblance. When the central islands of skin appear, the old integument had not been wholly destroyed; and it is from the remains of original *cutis vera* that such insular pellicles have been formed, not from granulations altogether recent. As a general rule, integument is formed by and from integument. But it is well to bear in mind that exceptions may and do occur. For instance, when there has been much loss of substance, undoubtedly involving the entire thickness of the cutis to a considerable extent, as after burn, part of the formation of new skin may be effected in the usual way; then the process may remain stationary for a long period, as if the old skin had become wholly exhausted in the formative effort; and, after a long delay, a cuticular film may be seen arising from granulations, at one or more points, spreading to meet that which had come from the circumference—as if Nature, foiled in her ordinary mode, had reluctantly found herself constrained to adopt another, held in reserve for emergencies only.

It is not intended to be understood that the original skin sustains both the production of the organizable material, and the management of the organizing process; the major part of the blastema, whence the cuticular formation is produced, is doubtless furnished by the parts immediately beneath—granulations; and these may also contribute much to the organization. But the process of the organization is commenced by the original skin, in that portion of the blastema with which it is in immediate contact; and continuance of the process is then doubtless maintained by those parts, whether recent or old, with which the advancing pellicle comes in contact. All deviations from such arrangement are but deviations from the general rule. And a close analogy will be found to obtain in repair of the hard textures; new osseous formation originates with the parent bone, and is then continued apparently by periosteum, as well as by other soft textures which may have assumed the place and function of that membrane where deficient.

After cicatrization is complete, the work of absorption still continues for some considerable time; gradually diminishing the amount of new texture, and sometimes, as already stated, bringing the primitive tissues into almost absolute contact. The new material, in this respect, bears a strong analogy to the temporary callus in fracture.

The healing process resulting from combination of cicatrization with granulation may be obstructed by various circumstances. True inflammation, its most formidable foe, is fatal to it. The fibrin becomes once more aplastic; and the process of granulation is arrested. But besides, all new structures being especially prone to ulceration, this follows on the inflammatory reaccession; and in consequence granulation is not only hindered, but undone; what has been already raised in repair, is probably disintegrated, and crumbles away. And the process of repair will not again be restored, until the true inflammation, and with it ulceration, has satisfactorily subsided. On the other hand, an obstacle may arise from deficient, instead of excessive, vascular excitement; there is a want of fibrin, the secretion being merely of thin fluid, rather mucous or serous than purulent; out of which, granulations cannot be constructed, and the chasm remains unclosed. But this part of the subject will be better elucidated, when treating in detail of the various kinds of ulcer.

The theory of the healing process will be found included in all works treating of inflammation in its general relations. See especially the works of Hunter, Thomson, Travers, Addison, Bennett, referred to under this head: see also Vogel's Pathological Anatomy; Lebert—Physiologie Pathologique; and Paget—Lectures on the Processes of Repair and Reproduction after Injuries, in the Medical Gazette for 1849. The most strictly practical literature of the subject will be found under the heads of Ulcers and Wounds.

CHAPTER IV.

SUPPURATION.

PUS (p. 123), it has been already stated, may be formed either in the parenchyma of a part, or on its free surface (p. 125). The former condition is termed *Abscess*—of great frequency of occurrence, and of much import to the practical surgeon.

Acute Abscess.

When suppuration follows the inflammatory process of an acute and sthenic kind, we find the morbid state resolvable into three parts, as formerly stated (p. 124); capable of being represented by concentric rings. Within the central will be found the pus, extravasated blood, and broken-up original texture. Within the second, is fibrinous exudation, at least partially plastic, and more or less advanced towards organization; limiting, or tending to limit, the suppuration within the central space. The third or external circle represents the diffuse serous infiltration, which invariably surrounds, more or less, the central and more important change.

When this threefold state has continued for some time—and more especially when the duration is such as to warrant the appellation of chronic being given to the abscess—the limiting fibrinous deposit becomes more and more condensed, its central aspect ultimately assuming a membranous appearance and a membranous function; having a smooth villous surface, somewhat like the mucous, and possessing a power of maintaining the formation of pus. Hence it is termed the *Pyogenic membrane;* endowed with very considerable capability of secretion, but as an absorbent surface comparatively feeble. In regard to this latter point, however, it may be useful to remember that the pus globule, when extra-vascular and complete, is of comparatively large size, not soluble in its own serum, and therefore but little amenable to ordinary absorption; the serous portion of pus may be taken up readily enough, but the solid part probably remains but little affected. And thus the feebleness of absorbent power may depend, not so much on defect of either structure or function in the pyogenic membrane, as on the nature of the fluid on which it has to operate.

Sudden suppression of purulent formation is always to be regarded as an untoward event. It is more liable to occur in the case of free and open suppuration, than in an unopened abscess. It may be the result of some accidental occurrence, the nature of which we may be unable at the time to ascertain; or it may be caused by injudicious stimulation wilfully applied to the part, reinducing the true inflammatory crisis, and for a time at least arresting secretion—even of a morbid kind. The suppression, however induced, is liable to be followed by irritative fever; usually of a formidable character, and with difficulty allayed. Or, on the other hand, the local result may follow on the general. A patient laboring under a discharging wound may become the subject of febrile accession, altogether independent of the previous affection; and, during persistence of such fever, the purulent as well as the other secretions will be either arrested or impaired. Whatever the cause of purulent suppression, there are few events that bring more serious and well-founded alarm to the practical surgeon. As will be afterwards seen, it is often connected with the condition termed Pyæmia.

Supposing that no accident occurs, the usual course of an abscess is to enlarge, and to approach the surface. The purulent is a waste aplastic fluid, to all intents and purposes a foreign matter, and must be removed. We have just seen that it is little liable to absorption; the only other alternative of removal is by direct evacuation. In most cases, this should be the work of the surgeon. But Nature has a mode of her own, and is to a certain extent independent of his interference. The process is as follows:—The matter, by continuance of secretion, gradually and steadily accumulates in larger quantity; and the effect of such accumulation plainly is to make pressure on the surrounding parts. They are thus, to a certain extent, pushed aside to accommodate the increasing fluid; but the accomodation so obtained is insufficient, and the pressure, not being relieved by adequate extension of texture, occasions more or less absorption of the parts compressed. The fibrinous barrier is not undone, but pushed back; and the surrounding parts are partly condensed by the mechanical result, partly diminished by interstitial absorption, the vital result of the pressure applied. As expansion of the barrier and cyst takes place, these are not attenuated; on the contrary, by continuance of fibrinous deposit, they are maintained unbroken and efficient; the interstitial absorption is in the textures exterior to them, comparatively uninvolved in the original action. According to merely physical laws, this pressure, effecting an enlargement of the suppurated space, should act equally in all directions; and were the process to occur in dead matter, such would doubtless be the case; but in the living, it is different. The pressure acts more at one point than at the others; and that point on which it is as it were concentrated, is usually towards the external surface. There the amount of pressure is increased; other vessels besides the absorbent are implicated in the result; the vascular system, already roused, is still more excited; true inflammation is induced; ulceration follows, and by its crumbling agency the parts intervening between the pus and the external surface are gradually removed; at each step the matter becoming more and more superficial. The original fibrinous barrier—and the pyogenic membrane, if it exist—are of course destroyed at the ulcerated point. But it does not thence follow that the pus may at that point overpass its limits; becoming infiltrated into the surrounding tissues, open and unresisting; and thus converting the circumscribed or limited form of abscess into the diffuse. Ulceration is accompanied and surrounded by fibrinous deposit—the second ring of the inflammatory process (p. 100); and this supplements the breach made in the analogous structure of the original abscess, preventing that deficiency of the barrier which would otherwise occur at the ulcerating part.

This process is termed *Pointing*. Its further explanation is difficult. And instead of attempting to assign any explicit reason for its occurrence, it is probably better simply to announce such outward tendency of pus as a well-known and admitted law of life. The progress is various; sometimes rapid, sometimes protracted and tedious; depending on the intensity and kind of the inflammation, on the rate of fluid accumulation, and also on the nature of the intervening parts. If these are of a fibrous structure, we know that they will long resist ulceration, and consequently retard the progress of the pent-up matter beneath—almost always injuriously. The ordinary areolar tissue, on the other hand, gives way readily and rapidly. Ultimately the skin alone resists. This becomes attenuated, stretched, and completely deprived of its support, for a certain space—usually of no great extent; for the abscess enlarges in a conical form, its apex towards the surface. The stretched and undermined portion of skin sloughs; is quickly detached; and the aperture, thus formed, admits of the pus being discharged.

As the matter becomes superficial, its existence is indicated by what is termed *Fluctuation*. The fingers are applied over the part, lightly; and either by alternate pressure, or by keeping one still while another is made to tap lightly on an opposite point, an impulse from the fluid is more or less distinctly perceived; the more superficial, thin, and copious the matter, the more marked its impulse. When, on the contrary, the pus, yet recent, is but scanty, and the superimposed texture both thick and dense, the sensation imparted is obscure. Experience and acuteness of touch are both required, under such circumstances, to prevent mistake in diagnosis. The surgeon possessed of both, with the additional faculty of using them aright, is said to be endowed with the *tactus eruditus*—a gift of rare value; perhaps partly innate, yet doubtless capable of being acquired by education of both the finger and the judgment. The adipose tissue, when abundant and somewhat tense, has an elasticity which simulates rather closely the fluctuation of abscess. The junior practitioner should, by frequent practice, early learn to discriminate between the two sensations. And should opportunity offer, let him not neglect to contrast also the elasticity of the medullary tumor; many examples of which imitate accumulation of fluid still more closely.

But the progress of matter is not always to the external or integumental surface; it may be to the mucous. By another law of life—as hard of explanation as the preceding—when integument is either distant, or separated from the pus by dense fibrous texture, the ulcerative process takes place not in that direction, but towards a mucous outlet should this be in the vicinity. Serous membrane, fortunately, has no such attraction. It, being fibrous, resists the ulcerative process; as all such textures do (p. 130). Thus, when matter has formed immediately exterior to the peritoneum, in the abdominal parietes, it has fibrous texture on either aspect; and the external is the more dense and unyielding. Yet so strong is the natural tendency outwards, when no convenient mucous surface is near, that in almost all such cases the outward progress is steadily maintained through the more dense, thick, and unyielding investment; the peritoneum, for at least some considerable time, remaining entire, and saving the abdominal cavity from dangerous purulent irruption. Whereas, when abscess has formed in the deep areolar tissue by the side of the rectum, very often before it has pointed externally on the hip, it has made its way by an ulcerated aperture into the cavity of the bowel, and thence been discharged. And, in the same way, abscess of the lung, or even of the pleura, is more likely to be discharged through the bron [illegible] make its way through the thoracic parietes. How [illegible] ement, whereby important internal cavities are inve [illegible] e as effectually resists the inroad of advancing mat [illegible] canals, terminating on the general surface, are cal [illegible] and discharge the noxious formation!

Especially important tissues—the arterial, venous, and nervous—may traverse the cavity of the abscess; or, though at first not implicated, may be eventually exposed to the matter's contact by enlargement of the suppurated space. Again, by an effort of Nature, such parts are protected; at least for a time. They are incrusted by a fibrinous deposit, dense and compact; which, as if itself bearing the weight of the pressure occasioned by the accumulating fluid, saves the important part which it invests from ulcerative destruction. Only for a time, however, be it well remembered. For should the relieving incision be unwisely withheld, both the protector and the protected are overborne; and the disasters of hemorrhage, false aneurism, or destruction of texture, certainly ensue.

The *Symptoms* which accompany and denote the formation of abscess are sufficiently plain. These are the ordinary signs of inflammation; pain, heat, redness, and swelling. Centrally, the swelling is soft and fluctuating; exterior to the soft suppurated centre, is the hard unyielding barrier of fibrin; and exterior to both is the soft, diffused, pitting swelling from serous effusion (p. 102). As the matter accumulates and points, fluctuation becomes more distinct, the central soft space enlarges as well as becomes more prominent, the surrounding induration recedes, the general swelling assumes a more conical form, and towards the apex of the cone the redness gradually passes into a yellowish tint, the pus showing its own color through the attenuated integument.

Throbbing and increase of pain, in general, immediately precede suppuration; and rigor usually marks its occurrence. Should the inflammation then subside, as it frequently does—as if exhausted in the effort of having attained to its true crisis—and if the suppurated texture be loose and yielding—the uneasy sensations, though not wholly absent, decidedly abate; and on the thin portion of skin giving way, they are still further relieved. If, on the contrary, as formerly shown (p. 126), the tissues be dense and unyielding, or the inflammation from any cause sustained, the pain, throbbing, heat, and tension are undiminished, or probably rise to an aggravated intensity.

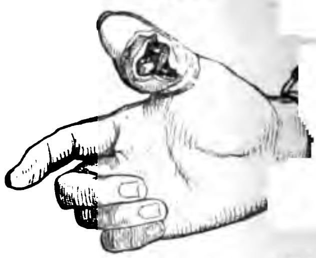
The constitutional symptoms are inflammatory in the first instance; and then these either simply subside, or change into those of hectic, as formerly explained (p. 126).

Treatment.—The indications to be fulfilled in the management of acute abscess are, 1. To remove remaining inflammation. It has been already stated, that, on the formation of matter, the morbid process which caused it often subsides spontaneously. If not, antiphlogistics are to be continued. 2. To remove all sources of excitement from both system and part. The former half of this indication is met by maintenance of the antiphlogistic regimen; in regard to the latter, foreign matter is taken away, muscles are relaxed, and the part is so placed as not to be ruffled or otherwise irritated from without. 3. To encourage the matter's approach to the surface. For this, nothing is so effectual as the constant application of hot poultices, frequently renewed, along with maintenance of strict quietude of the part; and at each renewal of the poultice, hot fomentation may be used for some minutes. The hot and moist applications are of use, antiphlogistically, in more effectually mitigating the vascular excitement which may remain; besides, by favoring relaxation of texture, they promote enlargement of the suppurated space—whereby, as we have seen, approach to the surface is effected (p. 182); tension and undue pressure are also avoided, which otherwise might occur, reinducing inflammation all around. 4. To evacuate the matter by an early and free opening. Abridging Nature's effort by artificial means. 5. To subdue the fresh vascular excitement which the infliction of the artificial opening must necessarily induce. Fomentation, poultice, and rest, are still adequate to this. 6. To promote the contraction, filling up, and ultimate closure of the cavity of the abscess.

The three first indications are not to be long persevered in, ere the fourth is arrived at. Three or four days at the utmost—sometimes only as many hours—will suffice for fomentation and poultice; and then, according to the principles of sound surgery, evacuation should be performed. It is no doubt true that Nature is herself equal to overtake this result, unaided; and the mode of her operation we have shown (p. 182). But the completion of that task, often laborious, should seldom if ever be demanded of her in acute abscess; otherwise harm must accrue. 1. Time is unnecessarily wasted. Nature's mode of evacuation is a gradual and tardy process; the plunge of a knife is the work of an instant; and it may happen, not unfrequently, that time is all-important to the patient. 2. An unnecessary amount of pain is endured. Though after suppuration the painful feelings attendant on inflammation usually subside, yet they do not disappear; not unfrequently pain continues tolerably severe, and is not assuaged until (by evacuation of the matter) pressure, tension, and ulceration have been effectually removed. The pain of opening may not be slight, but it soon passes away; it is but as a moderate cost of a most valuable purchase. And if chloroform be employed, no pain need be felt at all. If the suppurated texture be fibrous, osseous, or otherwise unyielding, pain is invariably aggravated instead of being abated by the formation of pus; and therefore the expediency of early evacuation is still more obvious under such circumstances.

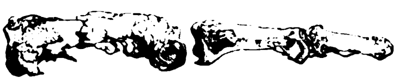
3. Texture is greatly endangered. In the ordinary progress of an acute abscess, favorably situated, the majority of the surrounding parts are pushed aside, condensed, and infiltrated by fibrin and serum; while at one point actual destruction of texture takes place, by the disintegrating process of ulceration. But if the natural effort outwards be balked by resisting texture, as it is almost certain to be in deeply seated abscess, then pressure is increased to a dangerous degree, at other and various points; and those parts which otherwise might have been merely displaced, and temporarily altered in structure, now become the prey of a morbid process which is destructive. Areolar tissue is broken up, muscles are separated, periosteum is detached, bone ulcerates or dies, cavities and canals are [illegible]vessels may be perforated, [illegible]y be stiffened or destroyed. [illegible]s may occur, even when the [illegible] process is gradual and of [illegible] kind, preceded by its fibrinous exudation; but it may happen that disintegration becomes unusually rapid, and the boundary of fibrin is transgressed; purulent irruption then takes place into the open and defenceless tissue, and both the extent and rapidity of disaster are fearfully increased. 4. The danger is not only local but general. Such destructive results, as have just been alluded to, cannot occur without involving the system in serious disorder. This would be the case, even supposing the parts so injuriously dealt with to be of themselves unimportant. But they may be such as in their lesion to peril existence almost immediately; hemorrhage may occur from a large artery or vein, by ulceration; there may be violent inflammation of an internal serous cavity, or clogging of the air-passages, by purulent irruption. It is true that important parts have not only an inherent power of resisting ulceration and other dangers from without, but besides are strengthened by an especial outward defence, as already shown (p. 184): these may avail to protect, until the abscess have been fairly formed and indicated, giving notice to the surgeon of its formation, and of the time for safe incision having arrived; but if this intimation be neglected, and this opportunity be overlooked, both the intrinsic and adventitious defence will be overcome, and danger and disaster ensue.

Fig. 28.



Danger of delaying incision, exemplified. Thumb lost in consequence.

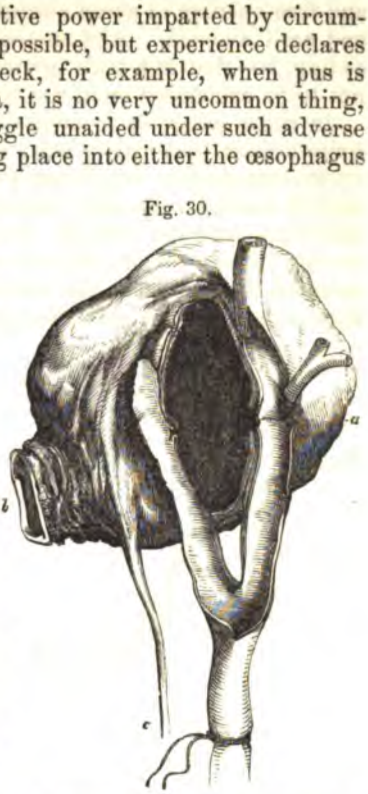
Fig. 29.



The illustration carried further; after maceration.

It has long been admitted that open abscesses, inflamed and undergoing ulceration—in fact changed from the condition of abscess, into that of an acute and spreading ulcer—may expose and perforate bloodvessels, and other important canals. But the power of unopened abscesses to perform similar ravages would seem to be by many doubted, if not denied, and made an excuse for delay in evacuation. That occult abscesses, however, have such destructive power imparted by circumstances, not only does theory admit as possible, but experience declares as a fact. In deep abscesses of the neck, for example, when pus is bound down by the dense cervical fascia, it is no very uncommon thing, when Nature is culpably left to struggle unaided under such adverse circumstances, to find an opening taking place into either the œsophagus or trachea; and recent examples have not been wanting of still greater hazard, by perforation of either the carotid or the internal jugular.[1] In the one case, a form of False Aneurism is established; in the other, the train is laid for troublesome, and it may be fatal hemorrhage.

Fig. 30.



Mr. Liston's case. *b*, the external opening of what was an abscess. *a*, the ulcerated communication between the cyst and the carotid artery; the latter has been sliced open. *c*, the par vagum.—British and Foreign Review, No. 29, p. 155.

It is worthy of note, in a practical point of view, that such suppurative lesion of the vascular tissue is especially apt to occur in young people after Scarlatina; and that, in the open condition of sore, the vein is more apt to suffer than the artery. It may be added, that a chronic abscess which, after having attained to some size, has suddenly become acute, is especially dangerous in this way; all the more if bloodvessels of any size happen to lie between the abscess and its approach to the surface.

In former times, *maturation* of an abscess was talked of, as an event always to be waited for, and made to precede artificial evacuation. It was held as almost a maxim in surgery, that ere a knife could with propriety enter the cavity of an abscess, this should have attained to a certain size, not inconsiderable, and have become quite superficial. Such delay may be suitable enough in the case of suppurated areolar tissue, almost or actually subcutaneous; yet time and pain might both be saved even here. And from what has just been stated, it is very obvious that in all cases where the abscess is either deeply seated, or in the immediate vicinity of important parts, to practise delay is only to incur neglect and invite disaster. The general rule, therefore, undoubtedly is to make an early and free opening in acute abscess; time and texture are saved, and pain and peril avoided. And another general rule, arising out of the preceding, is—that in a truly acute abscess, cure by absorption of pus is not to be calculated on in the treatment.

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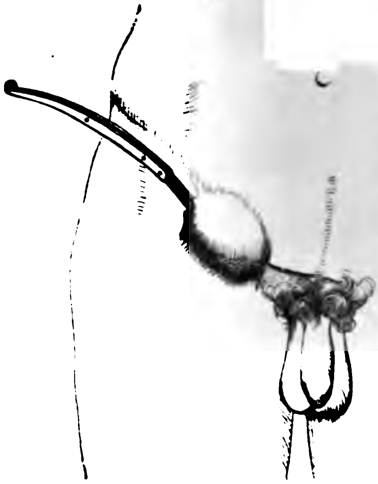
[1] British and Foreign Review, No. 29, p. 155; and Medico-Chirurgical Transactions, vol. 25, 1842; also London and Edinburgh Medical Journal, March, 1843, p. 177; *Ibid.*, April, 1843, p. 386; *Ibid.*, July, 1844, p. 632; *Ibid.*, April, 1845, p. 265; Lancet, 1025, p. 130; *Ibid.*, No. 1228, p. 287; *Ibid.*, No. 1377, p. 92; Liston on a Variety of False Aneurism, London, 1842; Liston's Practical Surgery, London, 1846, p. 189; Monthly Journal, Feb. 1852, p. 110; *Ibid.*, March, 1852, p. 277, &c. These are but some of the appropriate cases; there are others. One seems especially conclusive; in which the aorta, where in contact with an unopened abscess, was found ulceratively eroded *from without*; the inner coat alone remaining, attenuated yet entire.

In some cases, it is advisable to go a step further. When we are quite certain that matter must form in the inflaming part, and when we know that highly important textures are involved, it may be wise and well to make a very early wound, down to the centre of the suppurating part; not with the view of evacuating pus already formed, but in order to afford a ready and safe exit to the pus which we know is about to be secreted there. Thus, for example, fæcal fistula may be prevented in deep abscess of the abdominal parietes.

Fig. 31.



Abscess opened, from within outwards—Bubo.

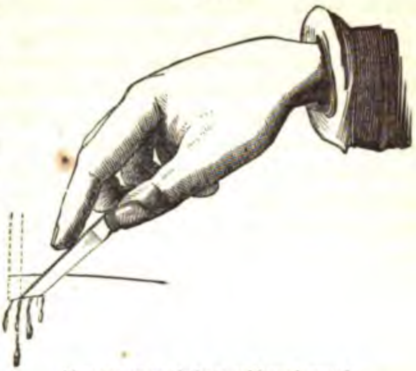
certain circumstances, how- purposely delay evacuation; when our object is to obtain on of a part. In obstinate enlargement, for example, w as resisted discussion, we usually endeavor to obtain suppuration—in its own texture if possible, but at all events in its immediate vicinity. Were we to open such an abscess early, the glandular tumor might after all remain entire and as obstinate as before; but in order to insure its breaking up and disintegration, we delay the opening, that the pressure of the pent-up matter may act destructively. Evidently, this exception corroborates the general rule.

Opening may also be prudently delayed, when the suppurated part is in itself unimportant, and when much active inflammation exists around—likely to be aggravated by early wound; as in some cases of very acute bubo. Then it may be well to wait till the part has calmed down; as tooth-extraction is wisely postponed, until the high excitement of gumboil shall have passed away.

The opening may be effected either by knife or by potassa fusa. In the great majority of cases the former is preferred, as less painful; more expeditious; entailing no loss of substance; and less likely to excite and maintain inflammation, which might extend and aggravate the original mischief. The preferable form of cutting instrument is the bistoury, sharp-pointed, with a fine edge, and either curved or straight. The curved is used when an abscess is superficial and prominent; puncturing the superimposed textures at their lowest and most dependent point, traversing the cavity of the abscess as far as may be deemed requisite for free evacuation, emerging from a puncture opposite to that whereby entrance was effected, and then by a rapid withdrawal of the instrument dividing the parts interposed between the points of entrance and exit. Or the process may be reversed.

The straight bistoury, on the other hand, is used when the surface is flat and the abscess deeply seated. The point is held perpendicular to the surface, and steadily advanced through the superimposed parts, until the cavity of the abscess is reached—as is indicated by absence of resistance, and the freedom of motion which the knife's point may be made to assume; then by a gentle sawing movement, the aperture is made sufficiently wide, ere the instrument is withdrawn. The bistoury should be held very loosely, and with readiness to let go on the instant, should the patient by an involuntary start jerk forward the punctured part. Also, when the thickness to be cut through is either considerable, or preternaturally dense, sudden plunging of the knife should be guarded against; by employing steady and gradual, rather than great and sudden force; at the same time resting the back of the bistoury on a finger of the left hand laid flat on the integument; otherwise the cavity of the abscess may be completely transfixed, and important parts wounded on the opposite side.

Fig. 32.



Abscess opened, from without inwards.

The opening should invariably be made dependent; that is, at the lowest part of the cyst; in order that it may afford a free and efficient drain for the purulent fluid, and thereby not only prevent reaccumulation, but also favor contraction of the original cavity. And in determining the point which is most eligible with this view, we must of course always take into consideration the posture which the patient is to occupy during the cure; what is dependent in the erect posture, may not be so in the recumbent.

Sometimes abscess forms in the immediate vicinity of large and important bloodvessels; as in the neck. And it may be alleged, in excuse for delay, that early incision cannot be made in such circumstances, without much risk to the vessels. It is not so. The abscess is a safe protection from the point of the bistoury; being interposed between this and the vessels—the latter on the further aspect. They may be injured, it is true, by a reckless plunge of the knife, or by an unnecessarily extensive thrust; but such things are not contemplated in the hands of a duly qualified practitioner. Any considerable quantity of matter having formed, in immediate contact with the common sheath of the large bloodvessels of the neck, an incision may be made fearlessly down on the ordinary and normal site of these parts, without dread of hazard. In the case of an early incision, the abscess protects the vessels—from the knife's point; when opening is delayed, the abscess may become their destroyer—by its own agency.

When the incision has been made through a considerable thickness of parts, there is a chance of the line of wound uniting prematurely: ere yet the cavity of the abscess has been closed, or its interior has ceased from purulent secretion. Re-establishment of the abscess necessarily results. To avoid this, such premature union is to be prevented; by the lodgment of a foreign body in the track. However simple and slight such foreign matter be, it is sufficient to prevent adhesion. A thin slip of lint is gently inserted with a probe, and retained. All stuffing and cramming of the wound is not only unnecessary, but certain to prove injurious; painful at the time, and sure to excite subsequently a grave amount of inflammatory accession, probably followed by new and more extensive suppuration.

Squeezing of the part, after incision, is equally reprehensible. Much unnecessary pain is inflicted, and the existing vascular excitement is not only maintained but agg [illegible] iting cause is applied. If the opening be dependen [illegible] hould be—the matter will find its way out readily er [illegible]

So soon as the knife [illegible] the more immediate gush of pus removed, a soft warm [illegible] ed; and into this the fluid continues gradually to ooze. But should the wound show a tendency to bleed unduly, the poultice should not be applied until the flow of blood has ceased; otherwise hemorrhage, being favored, might prove troublesome. When the contents of an abscess are of a flaky and semi-solid consistence, as often happens in patients of tubercular tendency, the aperture should be especially free, so as to facilitate and insure an effectual discharge.

Poulticing is continued until the vascular disturbance which attended on the suppuration, and which has been somewhat increased by addition of the fresh stimulus of incision, satisfactorily abates; until the textures have been sufficiently relaxed, and purulent discharge fully established: such discharge seeming often to have a resolutive effect on both the vascular excitement and the surrounding structural alterations. But poulticing may be, and often is, overdone. If continued after resolution of both the inflammation and its structural change, harm is done by over-relaxing texture, maintaining congestion, and consequently prolonging redundant discharge; pus, too, may come to occupy infiltrated parenchyma, where but simple exudation was before—more especially if the inflammatory process happen to be of asthenic tendency.

True inflammation usually accompanies the first establishment of purulent secretion; but congestion, either active or passive, is equal to its maintenance (p. 123); and a part constantly sodden by a hot and moist poultice cannot be otherwise than congested. There is no doubt that many open abscesses, and many suppurating wounds, are kept from healing, and an exhausting or hectic effect produced on the system, by an undue continuance of poulticing. The first two or three days, after opening, usually suffice for subsidence of the major part of the inflammatory process; and then the poultice is to be superseded by simple water-dressing, applied tepid; not with an antiphlogistic view, but merely protective, soothing, and abstergent. A piece of lint, doubled, steeped in tepid water, and gently squeezed so that water may not flow from it after application, is placed softly over the suppurated part, and covered by a portion of oiled silk of considerably larger dimensions; the object of the latter being to secure the epithem in its place, to retain also its heat and moisture by prevention of evaporation, and to prevent soiling of the bed or body clothes by the probable oozing of fluid. This lint is removed as often as cleanliness and comfort demand; not oftener: "nimia diligentia" in such matters is but sorry surgery, as will be afterwards explained.

The progress towards cure is usually as follows. After opening, inflammation is produced in and around the abscess, by two exciting causes; the injury inflicted by the knife; and the stimulus, not inconsiderable, caused by sudden contact of atmospheric air with the interior of the abscess—a part previously altogether unaccustomed to such influence. This fresh vascular excitement, we have already seen, is usually subdued in a few days, by rest, fomentation, and poultice; but not before important change has been thereby effected. It induces ulceration in the exposed surface of the abscess; disintegrating the pyogenic membrane, when that exists. But the action being transient, so is the ulceration; exudation of fibrin continues, and, by subsidence of inflammation, becomes at least partially plastic; a portion, perhaps the greater, still degenerates into pus; but the remainder, adhering to the surrounding original texture, becomes organized; assuming the structure of fibro-areolar tissue permeated by capillaries, and becoming converted into granulations. And these occupy the place of the pyogenic membrane, or of the fibrinous deposit which was being transformed thereto—for, in recent acute abscesses, time may not have been afforded for completion of the membranous change. In other words, a suppurating surface, with destructive tendency, is exchanged for what is granulating and reparative. Granulations have been already explained to be merely organized and vascularized fibrin (p. 177), peculiarly arranged—in the form of small, conical eminences; pointed, red, vascular, and sensitive; bleeding, when even slightly touched; and the blood is of a florid arterial hue. They not only occupy the place, but assume also the function of the pyogenic membrane, to a certain extent. For pus is essential to their normal state. They require protection from atmospheric influence, and other source of injury from without; and the power of secreting thick healthy pus in moderate quantity is given to them for this purpose, that they may coat themselves with an adherent yet ever-changing covering, until finally and more effectually protected by new skin, on the completion of cicatrization (p. 177).

By the organization of fibrin to a greater or less extent, in the form of granulations, new matter is obtained for filling up the chasm; but it is not by this process alone that closure is effected. The surrounding primary textures, which had been condensed and displaced during the formation and enlargement of the abscess, being now relieved, by a vital resiliency seek their former condition. Formerly they receded; now they practise a directly reverse movement—centripetal. And thus by a simultaneous occurrence of this expansion of the original tissues, with the formation of new substance to repair the loss by ulceration, the cavity of the abscess partly contracts, partly is filled up; and the granulating, suppurating surface becomes superficial. Cicatrization, by the formation of new skin for permanently investing the raw surface—the last part of the process of cure—is then effected; as has already been related (p. 178).

During the progress of these events, water-dressing is applied, tepid. Should the character of the granulations indicate debility, the application is to be medicated; variously, according to circumstances, as will be afterwards explained. Reaccessions of the inflammatory process may take place; these are to be carefully guarded against, and, when they occur, combated by the usual means. When the site of abscess is deep, care must also be taken that the superficial portion do not close prematurely; by occasionally interposing a slip of lint, or other dressing, so that the contraction may proceed uniformly, from the bottom upwards. Should the part become pale and flabby, with secretion of thin pus, and tendency of this to accumulate and remain in the cavity, general support of the p [illegible] pressure over the cyst, by bandaging, are advisable. [illegible] the system should be looked to; and will probably be [illegible] pport likewise.

In certain cases, caust [illegible] knife. In a small chronic abscess, in which opening [illegible] the integuments are attenuated to a considerable extent at the most superficial point. On discharge of the matter, they have not power sufficient to recover cohesion with the subjacent parts; and perish sooner or later, either by ulceration or by sloughing. The use of caustic under such circumstances not only opens the abscess, but by at once destroying the feeble and thinned integument, expedites the healing process, and renders the cicatrix more sure and permanent. Or, in addition to such a state of matters, obstinate glandular enlargement may exist; abscess having formed in the areolar tissue around it. Were evacuation to be performed by incision, this gland would continue to project centrally from the wound, and thereby delay, or perhaps altogether prevent cicatrization; besides, it is an object to get rid of such morbid structure, even supposing it were not an obstacle to healing. Let the caustic which effects the integumental opening be thrust into the gland in one or more places, and the result is a suppuration which disintegrates the whole. Also, if a patient decidedly object to the knife's use, from timidity or prejudice, and unwisely shun one pain to incur a greater, caustic may be employed. The best form is the potassa fusa, pressed firmly on the part till the abscess is entered; moved laterally, also, if need be, to destroy integument; or pushed deeply, to break up glandular enlargement. Oil or vinegar is then applied to neutralize the redundant alkali; so saving the surrounding parts; and the whole is covered with a poultice.

Chronic Abscess.

The formation of chronic abscess is a comparatively slow process, in all respects; most liable to occur in those of feeble constitution; and produced by inflammatory disease, which is either chronic or subacute and transient. The attendant symptoms—redness, pain, swelling, tension, heat—are comparatively trifling; some of them may be altogether absent; and the progress, whether superficially or in any other direction, is tardy. Indeed it is probable that in the truly chronic abscess, enlargement of the suppurated space never occurs by ulceration, but is effected merely by condensation, and by interstitial and continuous absorption of the surrounding parts; unless, indeed, acute accession supervene. There is little or no surrounding exudation of fibrin, further than what is necessary to constitute the pyogenic membrane; and by this circumstance the enlargement of that membrane, along with condensation of the surrounding parts, is manifestly favored. The pyogenic membrane, being more leisurely formed, is more fully developed, more highly organized, and probably possessed of both absorbent and secerning power to a higher degree than in the acute abscess. The pus is thin, its serous portion predominating largely over the globules; and this circumstance, conjoined with the greater efficiency of the lining membrane, renders the contents of a chronic abscess comparatively much more amenable to absorption. We have no hope of curing an acute abscess without evacuation; in the chronic, discussion is not unlikely to prove successful.

Sometimes the liquor puris is absorbed, while the solid particles remain in a compact and condensed form. Such an occurrence, for example, is by no means uncommon in the testicle.

It may be imagined that the disappearance of abscess by absorption of its contents, though a desirable result as regards the part, may be fraught with danger to the system; from admixture of noxious fluid in the circulation. But it is to be remembered that the process is a very gradual one, and that the fluid absorbed is probably altogether of a serous character; and further, that such absorption previously to an external opening having been made, is much safer than when atmospheric contact has been permitted—an apparent effect of this being to deteriorate the purulent fluid. Sudden suppression of discharge, and direct admixture of pus with the circulating blood, are likely to be followed by serious constitutional disorder, as already stated (p. 182); but by the gradual absorption whereby disappearance of an unopened chronic abscess is effected, the system is usually little if at all disturbed.

Chronic abscesses are found to vary, from the smallest size, to cavities capable of holding two or more pints of fluid. When deply seated, the very indolence of their nature insures their attainment to huge dimensions, should their progress be unqualified by treatment. In all cases, approach to the surface is slow; for, the accumulation of pus being very gradual, pressure is not likely to increase so as to occasion ulceration; and, as already stated, there is comparatively little surrounding fibrinous deposit to hem in the secretion as it does accumulate—a circumstance which renders the occurrence of tension and pressure all the more improbable. Hence it is characteristic of the collection to enlarge almost equally in all directions, without the tendency to point which is observed in acute abscess.

Treatment.—When the abscess is *small;* stationary, or nearly so; or of itself showing signs of recession by absorption; and more especially if so situated as to render the avoidance of deformity by cicatrix extremely desirable—discussion is by all means to be attempted. The general system is to be put in good order, particularly as regards the secretions; the patient is to be denied much liquid of any kind, and enjoined to live sparingly on dry food; and exhalation may be at the same time increased. For seeing that the blood must, in its normal state, be more or less serous in character, the frame may be compelled, as it were, to maintain this essential condition by absorption of its own fluids. The iodide of potassium is cautiously administered internally, beginning with small doses; and a direct stimulant to absorption is applied to the part. This last indication may be variously fulfilled. The emplastrum gummosum, or the E. Hydrargyri, or a plaster composed of equal parts of each, may be applied; or the surface may be lightly and repeatedly blistered. But, on the whole, the preparations of iodine are preferable to all others; either in the form of ointment, or in that of simple solution. Experience is somewhat adverse to the former, more especially when combined with friction, as it usually is; over-stimulation is apt to occur, the vascular syste [illegible] s the absorbent, and chronic disease is converted into [illegible] unfavorable circumstances. It is better to pencil the [illegible] h the ordinary tincture of iodine, or with the follo [illegible], a scruple; iodide of potassium, two scruples; water, a [illegible] ased or abated in strength according to circumstances. Even with this application caution and watchfulness are necessary; and should signs of over-excitement appear, it must of course be at once desisted from; not to be resumed till the chronic state has been again established. Usually the skin becomes brown, cracks, emits serum, and is somewhat painful; but such uneasiness, when merely integumental, is not to arrest the use of the remedy; for, usually, while such is the state of the surface, the soft tumor beneath is found to be satisfactorily diminishing. Often thick crusts of hardened cuticle form during the use of this application; becoming only partially detached. They should be removed from time to time, so as to expose the recent formation beneath to the thorough operation of the remedy. A sea-voyage, more especially when somewhat protracted and rough, has been found effectual in discussing small chronic abscesses; as in the neck, or groin; perhaps in consequence of the profuse and continued exhalation from the general mucous surface, along with abstinence from almost all ingesta (which such uncomfortable circumstances usually produce), favoring absorption in a remarkable degree.

When a small chronic abscess is not stationary, but steadily enlarging; and more especially when it is situated in an important neighborhood—it should receive the same treatment as if it were acute. That is, free, early, and dependent incision; leaving the part to granulate and cicatrize.

Chronic abscess, when *large*, may be treated in two ways. 1. It may be dealt with as if acute. But in this there is some danger. The large pyogenic surface is certain to inflame, under the double stimulus of wound and sudden admission of atmospheric influence; and this inflammation is apt to be of a violent and intractable nature—entailing acute ulceration; discharge of much unhealthy matter takes place, usually more or less mixed with blood; and there may also be infiltration into the tissues around, through breach of the pyogenic barrier. Constitutional irritation, of a grave kind, necessarily follows such local mischief. And, accordingly, after incision, the treatment should for some days be very soothing, watchful, and guarded, as regards both part and system; that such disaster may be if possible avoided, or at all events limited to a moderate and tractable form. After the period of danger has passed, the ordinary treatment of a granulating wound is to be pursued; bearing in mind that constitutional support will be sooner required than in the after-management of acute abscess.

But when, in the case of a large chronic abscess, the state of system is such as to indicate intolerance of inflammatory invasion, along with susceptibility to its attack—as is often the case—the other mode of treatment should certainly be attempted.

2. Our object is, by the subcutaneous and valvular form of an evacuating incision, to prevent atmospheric contact with the interior of the cyst. Inflammation of the cyst, and parts adjacent, is what we dread; and the cause of this, as already stated, is the double stimulus of incision and unwonted atmospheric influence; the latter being probably the more potent of the two. If the latter cause be abstracted, the former may be neutralized by rest and soothing treatment; and inflammatory disaster is averted. An incision, merely through the skin, is made about an inch, or an inch and a half, from the point at which we intend to penetrate the cyst. Into this wound a finely-pointed long trocar and canula are inserted, and pushed gently along beneath the integument; until, having reached the point of puncture, an elevation of the handle plunges the instrument through the pyogenic membrane. Assured of the canula's extremity being fairly lodged in the cavity of the abscess, we cautiously withdraw the trocar. The canula, where it projects from the wound—about an inch and a half from its external orifice—is furnished with an accurate stop-cock; and so soon as the point of the retreating trocar has cleared this—as is indicated by a mark made on the shaft of the trocar, for this purpose—the stop-cock is turned, and the trocar wholly withdrawn. A small exhausting syringe, neatly fitting the canula, and furnished with an ejecting tube, is then applied; the stop-cock is turned open, and by play of the syringe the purulent contents are slowly and gently evacuated. This having been effected, the syringe is removed, the stop-cock having been again shut; and the canula is cautiously withdrawn—the forefinger of the left hand following closely on its retreating point, so as to shut up the wound, and effectually prevent the admission of air. The wound's orifice is then covered with simple and tenacious dressing. Nothing is better than a small portion of porous lint, saturated in collodion, which is made to dry rapidly; and which, when dried, forms a protecting crust, at once adherent and impermeable. The tract is likely to close by the first intention. It has been proposed, in order to make the procedure more certain, to perform such manipulations under water; but due attention to all the steps of the operation, as just described, will render all other precaution against the air's admission quite unnecessary.

If no such instrument as I have described be at hand, valvular puncture may be equally well made with a common long trocar and canula. But during the escape of pus, especial care will be required to prevent, if possible, entrance of air; and with that view it will be prudent to stop, while yet the matter is flowing freely; leaving the cavity of the abscess but partially evacuated. It is during the saltatory interrupted gouts, at the end of an ordinary abstraction, that air is so apt to enter.

While the contents of the abscess are being gradually withdrawn, moderate and uniform compression should be applied to the part from without, to afford a compensatory support for that which is removed from within; and, after healing of the wound, this external support should be for some time continued. The precaution is as necessary as in tapping for ascites. If it be neglected, hemorrhage, by giving way of venous or capillary coats, is not unlikely to occur; the admixture of blood leads to deterioration of the discharge, acts as a foreign body, and kindles the adverse inflammatory process which we are so anxious to avoid. By such pressure, also, centripetal contraction of the surrounding parts, along with shrinking of the pyogenic membrane by interstitial absorption, is favored; and pur [illegible] is thus vitally, as well as mechanically retarded.

When reaccumulation [illegible] not wait for any approach to the former dimensions [illegible] period repeat the valvular tapping, at a different point, or at [illegible]—should that seem preferable. One or two repetitions may be required, ere the disease is overcome. But, on the other hand, after even a single performance the cavity may have wholly contracted, and absorption may have removed the remaining component parts of the abscess—solid as well as fluid; or the abscess may have so far diminished in size, as to render recourse to the ordinary treatment, by direct incision, both safe and effectual as a means of completing the cure.

The Abernethian mode of treating a chronic abscess—at one time much in vogue—consisted in making a small direct puncture into the cavity, partially withdrawing the contents, sealing up the wound with a view to adhesion, and repeating this operation frequently, so as very gradually to effect contraction of the cavity. Sometimes it proved succesful; more frequently it failed: in all cases it was tedious and troublesome. Air was admitted, the wound often failed to heal, frequent repetition was essential. It is now almost generally abandoned, as inferior to one or other of the modes here described.

Should the valvular mode fail; that is to say, should inflammation supervene, in consequence of accidental admission of air, or from any other cause, an instant transition must take place to the other mode of procedure. A free and direct incision must be made into the abscess, so as at once to evacuate all the contents. The subsequent excitement will probably be severe, and perilous to the system; yet it is to be unhesitatingly encountered, as the less of two evils. For were closure of the oblique wound maintained under such circumstances, the constitution would be certain to suffer to a much greater extent. A bad kind of purulent fluid is secreted from the inflamed surface; the general contents undergo chemical as well as vital change, in consequence of the presence of atmospheric air: and if such matter be kept pent up within the cavity, absorption of noxious material, both in the gaseous and fluid form, is inevitable, inducing a grave amount of irritative fever, probably tending towards a typhoid result.

Sometimes—indeed not unfrequently—the cavity of an abscess contracts only to a certain extent; and then becomes stationary, or begins to extend in an opposite direction. This may happen in the acute form;

but is much more likely to occur in the chronic. The opening which was originally dependent, and sufficient for effectully draining the whole space, may in consequence become insufficient; and a new aperture—or *Counter-opening*, as it is termed—consequently becomes necessary. It is made in the same way as the original opening; its site being chosen so as, along with the original, to command a complete drainage of the cavity in every part. It may happen that when the abscess has been large, undulating in its outline originally, or prone to subsequent extensions, two or more such counter openings may be required. In abscess of the scalp, for example, a plurality of wounds is often essential to efficient drainage. But, in the majority of cases, if the original opening have been well placed, and the rest of the treatment judiciously conducted, not even one additional incision need be made.

Sometimes the cavity fails to contract obliteratively, notwithstanding that the opening is in every way suitable. It may be that the pyogenic membrane is yet entire, secreting pus, and forming no granulations. Or granulations may be simply defective, and the centripetal movement of the original texture exhausted. Under such circumstances, we desire to excite inflammation. In the one case, it will disintegrate the pyogenic membrane by an ulceration; in both, it will bring fibrin to the part, which, on subsidence of the inflammation, will become more or less plastic, will be converted into granulations, and will hasten reparative completion. If there be but one opening, stimulating injections, varied in strength according to circumstances, may fulfil the indication; aided by continued pressure. If there be two openings, a few threads of silk may be passed through, and retained in the track for some days, after the manner of a seton, until the required amount of excitement has been obtained.

Sinus.

When the cavity of an open abscess has by contraction dwindled down into a mere canal—that is, a space in which longitude far preponderates over breadth—lined by a perfectly formed and well-acting pyogenic membrane, the condition is termed a Sinus. Not unfrequently, fibrinous deposit continues exterior to the secreting membrane; rendering the parietes of the canal thick, and of almost cartilaginous hardness. The discharge is thin, containing few globules; and resembling rather a depraved mucous than a truly purulent secretion. Left to itself, this state of matters might continue for a very long period. The obstacles to healing are—existence of the adventitious lining membrane, and the action being simply secerning instead of reparative.

The first thing to be done, is to ascertain the extent and form of the sinus; and whether it be single, or connected with one or more collateral branches. For this purpose, the ordinary silver probe is used; blunt-pointed, and pliable; and passed with all gentleness, yet with a curious care—so as to avoid perforation of previously sound texture, at the same time obtaining an accurate cognizance of the existing space. But, generally speaking, the former error is chiefly to be guarded against; as being both the more serious and more likely to occur. The probe has not unfrequently been passed forcibly beneath sound fascia, or through intermuscular areolar tissue previously unbroken; and, on withdrawal of the probe, the knife has followed in the artificial track, making a cruel wound where no wound was required.

Treatment of Sinus.—We are first to inquire whether there exist a cause whereby complete closure of the abscess has been prevented, and the reparative process has been lowered to the merely secerning. Such will not unfrequently be found. It may consist of foreign matter lodged in the part; introduced from without—and probably the cause of the original abscess, as well as of this subsequent degeneration; or it may be a decayed portion of the frame itself—as dead portions of bone, tendon, or fascia; or it may be formed by perversion of a normal secretion—as salivary, urinary, and intestinal concretions, escaped from their original site. If lodg[illegible]ers have induced the original inflammatory disturba[illegible]kely that they may escape along with the first conten[illegible]when this is freely opened, whether artificially or by [illegible]h is the mode which she adopts for their extrusion; matter is formed around them, and with this they are floated out, as it were, through the evacuating aperture. But the extrusion may either fail altogether, or be but imperfectly performed; and any foreign body, remaining impacted in the part, will not fail to prevent entire contraction of the open abscess; so establishing the condition of sinus. When such palpable cause can be found accounting for the origin and continuance of this morbid state, it is in the first instance to be removed. In effecting this, by probe, forceps, or scoop, some little injury is necessarily inflicted on the parietes of the canal; they bleed, are painful, and inflame; and the inflammation may be such as to disintegrate the lining membrane, and bring sufficiency of fibrin for active granulation. After extraction of the foreign matter, therefore, it is well to wait for a little; for this act may of itself prove sufficient to establish a cure. If not, stimulating injection may afford the aid required, in the way formerly mentioned (p. 197).

Still failing, pressure is had recourse to; not carelessly applied, but with a little management, suited to the end to be obtained. In the first place, we presume that the extent and form of the sinus, or sinuses, have been accurately ascertained. Over the track is applied a well-fitting firm compress; retained by bandaging, so as to make direct and tolerably severe pressure on the whole of the secreting surface—severe because intended to induce inflammation, which in its turn is to effect ulcerative disintegration of the pyogenic membrane. The desired inflammatory result having been obtained, pressure is removed, until inflammation and ulceration subside, and granulation commences. Then it is reapplied and continued, but with much less intensity; the object being merely to afford support to the granulating surface, and prevent accumulative retention of purulent fluid.

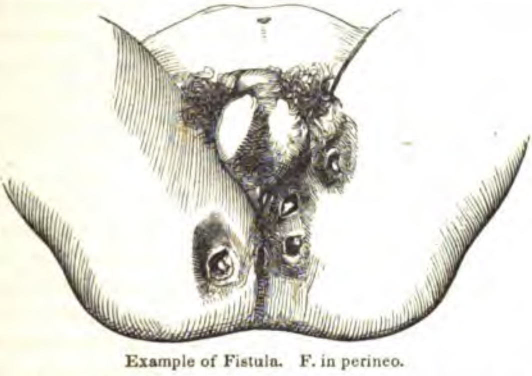
Should pressure fail—as it may do, the part being so dull as not sufficiently to obey the inflammation-seeking stimulus—then a more severe remedy awaits us; incision. Again supposing the probe to have been carefully and skilfully employed, it is followed by a probe-pointed bistoury; whereby the sinus is to be laid open throughout its whole extent. Usually it is superficial, and consequently not in the near neighborhood of important parts; hence such wounds, even when extensive, are seldom attended with troublesome hemorrhage or any other hazard. Should bloodvessels, or other important textures, lie in the way, they are of course to be avoided. The incision will certainly be followed by inflammation throughout its whole extent; for to insure this, and prevent adhesion at any point, a slip of lint is placed in the track, and retained until suppuration is established. By inflammation, the secreting surface is broken up and undone; the structure of granulation is raised on its ruins and in its stead; the part has been converted into the condition of an ordinary granulating wound, and we have only now to tend this process; insuring that it advances steadily and uniformly from the bottom, by preventing premature closure of its surface.

When sinus is both deep and extensive, it is neither necessary nor expedient to incise its whole space. Treat the outer half, at least in the first instance; and the probability is, that the inner portion will join the other in the inflammatory and curative results.

Fistula.

By this term is meant a further contraction of the sinus, with consolidation of its parietes. The abscess has now degenerated into a mere tube; with hard, thick walls; and often presenting a pouting orifice. The discharge is still watery; but ever and anon purulent reaccessions are apt to ensue.

Fig. 33.



Example of Fistula. F. in perineo.

For this state of things there is almost always a maintaining cause; to be found, and removed. Some foreign substance is lodged, as in sinus; and is to be taken away; by incision, if necessary. Or there may be some change of structure at fault; the result of a former inflammatory process. Thus, Fistula in perineo usually depends on stricture of the urethra; and if this latter be removed by suitable treatment, the fistula cures itself; it gradually closes and dries.

If, on removal of the maintaining cause, the fistula stills remains open, then the lining membrane is destroyed, and contraction favored, either by the use of incision as in obstinate sinus; or—what is often better—by a heated wire, applied accurately to the whole track. In the eschar the lining membrane is included; and, on its separation, the granulating surface of a burn remains—sure to bring contraction in its healing, as will afterwards be seen. One application may suffice. If not, repetition is made; but only at long intervals. It is the second effect of the burn that we desiderate—not the first; the healing and contracting, not sloughing and ulceration. Frequent use of the cautery would but enlarge the aperture we seek to close.

Constitutional Treatment of Abscess.

Throughout the whole of such local management of abscess, and its results, it is most essential that the state of the system be duly regarded. During progress and persis [illegible] nmatory process, antiphlogistic regimen is enjoined, [illegible] bably made of some of the simpler antiphlogistic reme [illegible] r antimony, with moderate purging. When the suppu [illegible] been fairly established, all lowering agents are to be dispensed with; and by and by support is given to the system, that it may bear up under the spoliative discharge, and under the tendency to hectic which that necessarily induces; such support consisting of food and drink, gradually increased in generosity, and followed if need be by tonics and stimuli.

Treatment of Hectic.—Hectic fever, the nature and symptoms of which were formerly considered (p. 42), may be connected or not with suppuration; most frequently it does occur in connection with the exhausting discharge, or with the structural change in important parenchyma, which suppuration usually occasions. Whatever the cause, it is very plain that this, if apparent and capable of being removed, should in the first instance be taken away; or, at all events, that means should be adopted towards the attainment of this end. Thus, if the febrile disorder attend on a copious discharge of pus from a large surface, as after direct incision of an extensive abscess, our object will be to moderate this discharge; and, by favoring granulation to the best of our ability, to expedite contraction and cicatrization. This will be effected by such management of the part as has been already mentioned; supporting also the system by food and tonics, that it may in the meanwhile endure spoliation until the salutary local change be completed. Such removal of the cause will be slow; yet not the less effectual.

Were it in our power to obtain sudden drying up of a purulent discharge to which the system has been long accustomed, we should not avail ourselves of that privilege; knowing that such an event would be almost certainly followed by irritative fever of a formidable kind (p. 182).

If the hectic cause be hopeless change of structure in a limb, connected or not with suppuration, it is removed by a more summary process —amputation; for it is better to lose a part of the body, than to peril the existence of the whole. The shock of such an operation, on a frame already worn and weak, is no doubt considerable. Yet it is surprising to observe how well it is usually borne;—as if Nature had for some time contemplated, and even desired, to part with the diseased portion of the frame; whose loss, consequently, creates less disturbance than in the case of traumatic or other sudden amputations. When the shock has passed, amendment is commonly found most marked and satisfactory; the pulse may have fallen twenty or thirty beats; all the febrile symptoms have abated—and may not return.

For some time after an operation, undertaken for relief of an urgent hectic, life may quiver in the balance, lightly poised. The cause for anxiety is great. Yet the treatment should be mainly expectant. The judicious surgeon is well contented to remain a passive though anxious spectator: he knows that the affair is much too delicate for the interference of his comparatively clumsy hand, and wisely does little more than await the far more dexterous working of Nature. The inexperienced and unskilful, on the contrary, is likely to deem it his duty to be then as well as at all other times busy; he plies sedatives, restoratives, tonics, stimulants; and, in consequence, the balance may be quickly turned—but not in favor of the patient.

What may be termed the general treatment of hectic, is conducted according to the principles formerly explained as applicable to constitutional irritation; of which, hectic is but a form (pp. 46 and 80). The system is succored by food and tonics; mild opiates are given to procure sleep, and calm restlessness and other nervous excitement; mineral acids, to check profuse and impotent perspirations; astringents, to check the tendency to diarrhœa, unless when this is dependent on mucous ulceration; and lastly, stimulants, should sinking threaten to ensue. Never forgetting, in regard to the last-mentioned class of remedies, that all depends on their mode of exhibition; if in large doses, with long intervals between, the fatal issue is likely to be accelerated; it is from small doses only, oft repeated, and each carefully watched in its effects, that a fortunate event can be expected (p. 81).

Diffuse Abscess, or Purulent Infiltration.

Abscess is said to be diffuse, when the suppuration is not surrounded and limited by plastic fibrinous exudation; and when consequently the pus—in such circumstances of a thin, apparently unhealthy, and perhaps acrid nature—is, so soon as formed, readily infiltrated into the surrounding texture, open and unprotected; with a result most disastrous to the part, and oppressive to the system (pp. 126 and 134). Areolar tissue is broken up, disintegrated, killed; integument is undermined, and subsequently sloughs; and the suppurated space is rapidly and greatly extended. For, the infiltration of such pus acts as a fresh exciting cause of an asthenic inflammation, similar to that from which itself sprung; and so the process of infiltration, suppuration, and destruction, may be prolonged almost indefinitely. This is bad enough, supposing the affection to be limited to the surface; but, although usually commencing there, it is apt to extend in depth as well as superficially; and the deeply seated result is all the more serious, in proportion to the greater importance of the parts implicated. The attendant constitutional symptoms are those of irritative fever, sometimes typhoid.

Treatment.—The local indications are—1. To arrest the inflammatory process, if possible, ere it has reached the suppurative crisis. This is difficult. For the disease is asthenic, and the progress is rapid essentially; else the surrounding and limiting circle of fibrin would not be deficient. The resolutive attempt is to be made, however, when circumstances permit, by antiphlogistics early and actively employed. The most potent of these is incision, practised early; with the view of evacuating not pus, but plasma, at the same time abstracting blood effectively. 2. When matter has formed (and too often it does form, in spite of our efforts to the contrary; and, more frequently still, it has formed before our attention is called to the part) our object is to evacuate what is already there, to limit inflammation and thereby prevent further purulent secretion, to save the surrounding parts from infiltration, and to grant an opportunity of escape to that portion of texture which may have already pe[illegible]an be accomplished by one proceeding, and by that c[illegible] bistoury is passed freely into the infiltrated part, th[illegible]space; making one or more wounds, according as the [illegible]ration may demand. The fluid already formed readily [illegible]ng with it a considerable quantity of blood; by this bleeding the vessels concerned in the morbid process are directly rifled of their contents; the probability is, that inflammation will in consequence subside; and subsequent formation of pus in the part originally affected, as well as continuous extension of the disease to neighboring parts, will be either diminished or altogether arrested. After bleeding has ceased, a light poultice, or the water-dressing, is applied. Suppuration for a time is tolerably profuse; for ulceration is necessarily in progress, to detach the areolar tissue which had perished ere incision came to its relief. In no long time, however, the slough is separated, and comes or is brought away; granulation is begun, the discharge becomes less copious and more laudable, the wound fills up, and cicatrization is duly completed.

In this disease, it is very plain that incision, as already stated, should be practised at an early period; so soon as we are satisfied that infiltration is begun. The longer the delay, the greater the danger to texture; and the greater the destruction to texture, the more serious the disorder of the system. This mode of local bleeding is the most likely means of arresting the advancing process, and so preventing suppuration altogether, except at the mere line of wound; a practice which will be more fully stated when treating of phlegmonous erysipelas.

After incision, the local treatment is as for an ordinary suppurating wound; applying early, gentle, and uniform support by bandaging, to prevent further infiltration of accumulated discharge; favoring cohesion of the partially undermined parts, now freed from their foreign fluid; and accelerating the general process of granulation.

The Irritative Fever (p. 44) is best treated by effectual and early removal of its cause; that is by the local management just detailed. Often little else is required. During the first, or partially sthenic period of the symptoms, antimony, belladonna, or aconite, may be given cautiously; softening the pulse, and allaying those symptoms of the febrile disorder which border on the inflammatory type. Afterwards, the period of debility having arrived, the same manner of treatment is required as for hectic, or constitutional irritation in general—into which form of disease the case has then in truth lapsed.

Secondary Abscess.

By *Secondary* or *Consecutive Abscess* I mean the formation of pus, not in the onward course of a main inflammatory attack; but during its recession, or after it has altogether disappeared. The event is more frequently observed in connection with the erysipelatous than with any other form of inflammatory affection; and more frequently in hospital than in private practice. An Erysipelas—it may be of the simplest kind apparently—has run its course; all trace of it is rapidly fading away; or even some days may have elapsed since there was any sign of the disease either in part or system. The patient feels, and is thought, well and recovered. But, unexpectedly, a shivering occurs, the pulse again rises, and the tongue fouls and dries as before; fever advances; and soon our attention is directed to painful swelling, either in the part originally affected, or at some distance from it—most frequently on the inner aspect. In erysipelas of the face, it is in the loose texture of the eyelids that we may expect the swelling; in erysipelas of the thigh it is on the inside of the limb, or in the groin; in erysipelas of the arm, it is on the inside of this, or in the axilla. But a few hours before, all may have seemed quite healthy; now the bulge is considerable; it is full of pus, usually of a thin kind; and the collection is rapidly on the increase; areolar tissue readily giving way before it, and skin becoming undermined; for the disease is asthenic, and there is a want of limiting plasma. Such abscess may be single; sometimes there is more than one. Most commonly, the plurality is not contemporaneous but successive. One is opened to-day; another shows itself on the morrow; that, too, is dealt with, and a third appears. I have seen in one limb twelve such abscesses, in less than the same number of days. If neglected, they rapidly enlarge, ultimately giving way; and serious constitutional irritation may follow. If opened early, suppuration usually ceases to extend, and the wound speedily contracts and heals.

The cause of these formations it is not easy to determine. It may be the mingling of pus with the blood: more probably, however, they depend on some more subtle poison there; similar to, if not identical with that which induces erysipelas, and other asthenic disorders. Often the phenomenon may be observed in cases where not a drop of pus had formed before—from abscess, wound, or sore; and where there was no sign of inflammatory affection either in lymphatics or in veins. And therefore, in such circumstances, it is not easy to understand how purulent admixture could have occurred. Often we have to blame—and that on good grounds—an accidental crowding of the ward, and an unhealthy season.

Whatever the cause, the disease is both troublesome and formidable. With a view to prevention, the erysipelatous patient is tended carefully, during convalescence, and after; the state of the general secretions being specially regarded. Admission of pure air is most important; and, if need be, for the fulfilment of this indication, change of locality is enjoined. So soon as the swelling appears, opening should be instantly practised; and, in the after-treatment, it is to be remembered that the part will soon show an intolerance of fomentation, poultice, and other relaxing remedies (p. 190). Constitutionally, there will be little need for antiphlogistics; alteratives and tonics come in their stead. There is some ground for the belief that chalybeates, during convalescence from erysipelatous attacks, have the power of control or prevention.

When Secondary abscesses occur in numbers, and at once, they are termed *Multiple abscesses;* and are then supposed to be dependent on purulent infection. In fact, they are but a part of the signs of that formidable disease, called *Pyæmia.*

Pyæmia.

By this term is unde ıd formidable constitutional disturbance, supposed to ıe admixture of pus in the circulating blood. At th ver, it is right to state that examples are not unfreq closely similar in kind and urgency, in connection with which admission of pus into the circulation cannot be traced. When the purulent admixture does occur, it is direct; not by absorption. For, as formerly stated (pp. 127 and 181), there is good reason to believe that pus globules cannot pass through the vascular walls entire; it is the serum alone which thus regains the vessels' interior. And it is generally understood that absorption of merely the serous part of pus is not likely to be followed by grave consequences; unless, indeed, it have previously undergone some decided change from the ordinary normal condition.

Pus may be admitted into the vessels, in various ways. In a suppurating wound, venous orifices may be free and gaping; and pus may be unwisely forced to remain accumulated there. During the progress of unhealthy ulceration, venous canals may be opened into. Lymphatics, inflaming, may feed themselves with pus. But, above all, suppurative phlebitis cannot fail to cause purulent pollution of the blood both rapidly and to great extent, if unfortunately the inflammation be of that kind in which the exuded pus is not limited by solidification of the vein's contents. If, in addition to mere purulent admixture, there be putrefaction or other deterioration of the pus itself, or the presence of some other poisonous morbific agent, then the symptoms may be expected to prove especially untoward and unmanageable.

How the pus acts deleteriously, it is not easy to determine. It may be by exerting a poisonous influence on the blood, and thence on the whole frame. But there is good reason to believe that the corpuscles act somewhat mechanically; becoming obstructed in the capillaries; and operating there as exciting agents of intense inflammation, which is asthenic, and runs rapidly on to suppuration; occurring in a part and system of diminished vital power, and disposed to evil results.

The symptoms have been graphically described by M. Sedillot: "A patient is attacked by suppuration; when suddenly, either without any premonitory symptom, or some days after a hemorrhage, a diarrhœa, a diffuse inflammation, a phlebitis, an erysipelas, or a painful engorgement of a wound, a more or less violent shivering fit comes on. Frequently there is observed a general trembling, chattering of the teeth, a drawing in of the limbs towards the trunk, and a morbid diminution of temperature of the skin; speech is difficult, the words uttered being short and interrupted; the eyes are hollow, and the features contracted; the countenance is of a leaden or yellowish color; the respiration frequent; the pulse small, soft, and rapid, and an instinctive sense of great peril is presented. The shivering ceases after a period varying from ten to forty-five minutes; the warmth of surface returns, and a slight transpiration is established. Erratic shiverings, however, return, and not unfrequently at the same hours as in the first instance; the wound dries up, or the suppuration becomes grayish and fetid; the surfaces of wounds assume a withered, flabby aspect; the bones become denuded, and ill-conditioned ulcers arise or extend. The patient seems as if exhausted by fatigue, and plunged into a kind of *coma vigil*, with occasional delirium, or into a deep stupor; the inspirations are made laboriously, and become more and more accelerated, so that thirty, forty, and fifty per minute are counted; the breath exhales a purulent odor; subcrepitating *râles* are heard in the chest, the air also not seeming to reach the minuter bronchial ramifications; the skin becomes daily more earthy, yellowish, generally as if jaundiced; articular pains, with swelling and intro-synovial effusion, manifest themselves successively in the various joints; one or both of the calves may become the seat of considerable[1] swelling, attended with great suffering; and sometimes severe stitches in the side of the chest force cries from the patient. The tongue becomes dry; the lips and teeth are covered with a fuliginous paste; the belly is tender, the pulse tremulous and rapid, subsultus agitates the limbs, the eyes look dull, the cornea has lost its polish, the bladder is no longer emptied, partial paralyses may manifest themselves, the voice is lost, and the patient dies from the fourth to the eighth day in a state of extreme emaciation, and after a prolonged struggle. These are the most common traits of purulent infection, but it is seldom that we find them all present." . . . . . . "Any wounded person having a suppurating wound, in whom irregular shiverings, difficulty and frequency of respiration, a leaden or icteric coloring of the integuments, great prostration of strength, and sudden wasting, manifest themselves, is, in our eyes, the subject of pyæmia. We would deliver the same opinion, if, in the absence of shiverings, the above-named symptoms were present, together with a drying of the wound, or a changed character in its discharges. The existence of an ascertained phlebitis allows of our pronouncing upon the invasion of pyæmia, the moment the local symptoms become complicated with shivering, prostration, yellow coloring of the integuments, and altered respiration. Arthritic pains and effusions, disorders of the nervous system, the typhoid appearance, induration, or abscess of the calves, &c. &c., add but additional degrees of certainty to our diagnosis."[2]

During life, pus may be detected, in most cases, in the blood, by means of the microscope; although here there is an obvious source of fallacy, in consequence of the great difficulty of distinguishing pus globules from the normal colorless corpuscles of the blood. After death, abscesses are found in the lungs, liver, spleen, brain, kidneys, heart, pleura, joints, muscles, subcutaneous areolar tissue.[1] The lungs are by far the most frequent site; and there, in addition to suppuration, patches of less advanced inflammation may also be found. Of muscles, the sural mass, the deltoid, and the pectorals, are those most frequently involved. Wherever situated, such abscesses are almost never single; internally, the [illegible] few in number; often they may be counted by hun[illegible]ate.

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[1] In the original it is "peu considerable;" but, according to my experience, the "peu" should be an error of the press. The swelling is often great.

[2] British and Foreign Medico-Chirurgical Review, October, 1849, pp. 354–56.

Treatment is more ho[illegible] than in cure. Avoiding the exciting causes of erysi[illegible]; moderating ulceration in sores; keeping wounds li[illegible] to prevent accumulation of matter within; having n[illegible]ls, community of dressings, or sources of mephitic [illegible] rigidly enforcing Hospital hygiene.

When the evil is tracea[illegible]ating surface within reach, some have confidence in applying the actual cautery freely to this; with a view of cutting off the noxious supply.

For the constitutional symptoms no fixed plan of treatment can be laid down. We are guided by the general therapeutic principles applicable to constitutional irritation (p. 79).

Prognosis is doubtful. Some patients emerge happily; bearing nothing but the scars of external abscesses; others escape with life, but permanently damaged in both trunk and limb; many sink and die.

For the literature of Suppuration, the same references may be used as for Inflammation in general. In connection with Secondary Abscess and Pyæmia, see Velpeau; Révue Médicale, tom. iv, 1826; Arnott on Inflammation of the Veins, Medico-Chirurgical Transactions, vol. xv, 1829; Cruveilhier, Dict. de Méd. et de Chir. Prat. tom. xii; Dance, Archives Générales de Médecine, 1828–29; Castelnau and Ducrest, Mémoires de l'Académie de Médecine, tom. xii, 1846; British and Foreign Review, Oct. 1848, p. 382; Sedillot, de l'Infection Purulente, ou Pyoemie, Paris, 1849; British and Foreign Medico-Chirurgical Review, Oct. 1849, p. 349; Monthly Journal of Medical Science, April, 1850, p. 331; Lee on Inflammation of the Veins, 1850; Gamgee, on Pyæmia, Association Medical Journal, March 4, 1853.

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[1] The following is M. Sedillot's statement of comparative frequency. In 100 cases of Pyæmia, the lungs are affected in 99; the liver and spleen, in 1 out of 12; the muscles, 1 in 15; the heart, in 20.

CHAPTER V.

ULCERS.

THESE are breaches of continuity effected by ulceration (p. 128); and may occur in any texture, though in some more readily than in others. At present, we have only to do with those which affect the surface; situated in the skin, or in the areolar tissue beneath, and seldom implicating the deeper parts. They are every-day occurrences in the practice of surgery; and as such are apt to be regarded lightly by the student, or perhaps even by the junior practitioner. But all should be made early to know how egregiously they err, in such an estimate of what in truth constitute one of the most important classes of disease with which the surgeon has to do. The very frequency of their occurrence renders it eminently necessary, that our art should be well prepared with efficient remedies; more especially when it is remembered, that these accidents are most likely to befall those whose limbs are of greatest value. The rich man, even when otherwise unhealthy, is comparatively exempt from ulcer of the limbs. The poor and laboring man is too often ill-fed, ill-clothed, hard-worked; all day in the erect posture, often wet and weary, and liable to external injury in the exercise of his calling. It is in such members of the community, that by far the greater number of ulcers are found; and usually of a formidable kind. Should the disease threaten in the rich, he lays himself up forthwith; the suitable remedies are employed—of which perhaps rest and position are the most important; and, in a few days probably, the part is cicatrized. But the poor man cannot afford to do so. His limb is ulcerated; as yet, however, it is not very painful, and he works on; it gets worse, but the erect posture is still practicable, and it is maintained; and often it is only after the sore has both inflamed and sloughed, rendering motion and the erect posture at length impossible, that the sturdy-hearted peasant abandons his labor, and applies for relief. In proportion to the reluctance of his application, is his anxiety for cure. His children depend upon his exertions for food; and if the period for treatment prove protracted, pinching poverty will too surely be their lot. Thus a heavy responsibility may be almost daily thrown on the practising surgeon; which he must be fully prepared to meet, else his portion cannot well be one of either happiness or contentment. And as the right understanding of a disease is, at least in one sense, half its cure, we proceed to the consideration of this subject in detail.

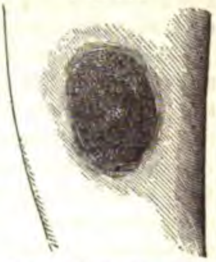
There is no more serious error than that of exclusively treating disease by name, and in the abstract; instead of inquiring carefully into the nature of each individual sample, and bringing forward remedies appropriate to each sign or symptom, as they occur. And there is every reason to believe, that such careless generalization in practice is found to affect the treatment of no disease more frequently than that of ulcers. One lotion, one ointment, or one plaster or poultice, comes to be regarded as quite a panacea; and is used in all cases indiscriminately—whether for benefit or hurt being a mere matter of chance, with probability leaning much to o avoid such injurious haphazard in treatment, it i understand, thoroughly, the nature of all the varietie rds this end,there is nothing so useful as a right clas iety showing its distinguishing characters, and bearing e its appropriate treatment. Not that we mean to designate each as a separate disease, but only as a separate variety of the same disease—ulcer; entreating the student to remember, that in the treatment of such affections much care and watchfulness are required; inasmuch as they have a great tendency to pass from one form into another, often by no very gradual and protracted transition; and that, consequently, an application which is altogether suitable one day, may on the next become very inappropriate.

Classification.—The following will be found to include the great majority of ulcers. Under one or other of the varieties every example may be arranged; or if the exact type be not there, it will be found somewhere intermediate, and easily deducible. 1. The Simple Purulent, or Healthy Sore. 2. The Weak. 3. The Scrofulous. 4. The Cachectic. 5. The Indolent. 6. The Irritable. 7. The Inflamed. 8. The Sloughing. 9. The Phagedenic. 10. The Sloughing Phagedena.

1. *The Simple Purulent, or Healthy Sore.*

This is in truth an example of healthy granulation; supervening on wound or abscess, or on inflammatory disintegration of a part previously unbroken in its surface (pp. 177 and 190). The discharge is thick, creamy, easily detached from the granulations, almost inodorous, not too profuse; in fact it is *laudable* pus. The granulations are numerous, small, acuminated, florid, sensitive, vascular; if touched at all rudely, they bleed and are pained; the blood is arterial, neither profuse, nor abnormal in quality; and the pain is but the just appreciation of injury done to a healthy part, not the extreme and persistent nervous impression of morbid irritation. The general sensation in the part, when not injured, is slight tenderness, or a feeling of rawness, rather than actual pain; not unfrequently, a sensation of itching is present, to an extent even troublesome. The granulations, when brought to a level with the surrounding skin—partly by subsidence of this from the state of inflammatory engorgement, partly by their own elevation—remain at that level; and the process of cicatrization is forthwith begun. At this stage, the integument surrounding the granulating surface has a slight tumescence; and is a little more red than in ordinary health, being more vascular. Its free margin is fringed by the growing pellicle of the advancing cicatrix; usually paler than the original skin. If the granulations are long uncovered, except by pus—whether on account of the large extent of granulating surface, or any other circumstance tending to protract cicatrization—the almost inevitable result is a degeneration in the character of the ulcer; which comes more or less to resemble the second class, whose characteristic is debility. This circumstance is very much affected by situation; the nearer to the centre of circulation, the more rapid is cicatrization, and the less the tendency to degenerate. A sore on the leg is slower to heal, and more apt to become weak, than one in other respects similar but situate on the arm; an ulcer of the trunk is more favorably disposed than either.

Fig. 34.



The healthy sore; in process of cicatrization. Pellicle of new skin represented round the margin.

Treatment.—This is simple, as is the nature of the sore. The part is placed and retained in a state of repose; and in such a position as at once to relax the muscles implicated, and favor venous return. Simple tepid water-dressing is applied; the pledget of lint not larger than is sufficient to invest the raw surface; not hot, for the object is not to relax; nor cold, otherwise it might prove stimulant, instead of grateful to the tender granulations. Its object is simply protective; assisting the purulent secretion, until the cuticular formation is complete (p. 178). When symptoms of debility ensue, it must cease to be simple, and become stimulant by medication.

When the granulating space has been diminished to a mere spot, adventitious protective aid is often well superseded by an effort of Nature; the secretion coagulates, and forms a dense, blackish, impervious, callous crust, under which the healing process steadily advances. It may happen, however, that even then discharge is redundant; and if such be the case, while the crust is on all sides adherent, the circumstances are unfavorable. The sore has, in truth, been converted into a superficial abscess; and the confined matter, by pressure on the tender and recent surface reinduces ulceration there. The part becomes hot, painful, red, and swollen; the crust is elevated and tense; and, on its separation, a deep ulcerating cavity is exposed. The possibility of such an occurrence, therefore, is always to be borne in mind; and the part examined from day to day. A slight touch of the crust will suffice to tell whether matter be accumulating beneath or not, and if it be, the crust must be gently removed, and water-dressing resumed. If there be no accumulation, Nature's protection is left undisturbed; it ultimately separates of itself, and on its decadence a completed cicatrix is disclosed.

The natural crust may be artificially imitated, if itself slow to form; by passing nitrate of silver lightly over the part, so as to coagulate the secretion; and then leaving this to harden and dry; or superadding, to become incorporated with the crust as it hardens, a small portion of fine lint or charpie. Or on a slight stroma of charpie a crust of collodion may be formed (p. 176).

Or the water-dressing—simple or medicated, according to circumstances—may be continued until the end of the cure. But then comes the question, not unimportant, how often is such dressing to be renewed; the oiled silk raised, the lint taken away, the redundant discharge gently removed, a fresh portion of lint laid on, and the oiled silk readjusted; with a slight retentive bandaging if necessary? The answer to such a question is—As seldom as possible; as frequently as cleanliness demands, and no oftener. [illegible]s seen soaking through the dressing, and beginnin[illegible]newal is had recourse to. For not only is the co[illegible]s such affecting injuriously not only the patient bu[illegible], besides, the discharge, becoming subject to chemical [illegible]ritant, and may induce degeneration in the sore, of an inflammatory type. There is then a necessity for change. But, until such necessity occur, let no change be made; inasmuch as it cannot be effected, however delicately and dexterously, without some injury being done to the tender surface by admission of atmospheric influence, as well as by rude mechanical contact. And by the oft repetition of this, again inflammatory degeneration may be induced. The "*nimia diligentia*" of surgery is fraught with manifold injury; and is an error against which the junior practitioner should especially guard. In practical surgery, nothing, however simple in itself it may appear, should be done without a good and substantial reason for its use.

Another error, at least equally pernicious with too frequent dressing, is an affected nicety in making the change of application; not only wiping away the redundancy of discharge, but insisting on a perfectly clean abstergence of the surface of the sore itself, till it look pretty and red; washing, sponging, rubbing, irrigating; thwarting Nature in one of her most beneficial acts; taking away, clumsily and rudely, the best protection of the tender surface; and invoking inflammation, or tendency thereto, with consequent degeneration of the sore. At each dressing, gently wipe away pus from the surrounding integument, but do not interfere with that which covers and protects the granulations; our dressing is subsidiary to this, and ought not to supersede it.

The means whereby the cleansing is effected are also a matter of some moment. Usually, it is by a sponge. But this is likely to prove injurious; especially in the wards of an hospital. A sponge is a thing of some value, in the eyes of a patient or nurse; and not to be lightly parted with. It is used not for one patient only, but for many, or all. It becomes soaked with discharge of various kinds; it is hastily and imperfectly cleansed, after each employment; and, ere its daily course is run, can hardly fail to have been the means of conveying noxious matter to previously healthy sores; inducing their degeneration, and perhaps exciting the serious complication of erysipelas. Instead of sponge, therefore, especially in hospital practice, let fine tow, lint, or soft linen rag be used as the abstergent agent; a thing of no value; and which, consequently, may be burnt as soon as used, and have no oppor- of carrying contamination. And, generally speaking, the basin of cold water, usually in attendance during the dressing, may be well dispensed with. Dry and gentle wiping of the surrounding skin, leaving the actual sore untouched, is all that is required. More is not only unnecessary, but tolerably certain to prove injurious; it belongs to the noxious "*nimia diligentia.*"

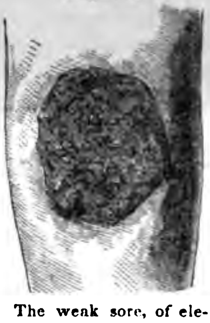
But our attention must not be entirely engrossed with the part. In all kinds of ulcers, the state of the system must be constantly regarded. As this deteriorates, so will the sore; and *vice versâ*. Indeed, a glance at the character of a sore is one of the best means for ascertaining the condition of the system; the ulcer telling us as truthfully as the tongue, pulse, or countenance. In the treatment of the simple healthy sore, it is plainly our duty, therefore, to rectify error in the system, if such exist, with a view to the ulcer retaining its healthy character, until cicatrization is satisfactorily completed. Our attention will be specially directed towards the *primæ viæ;* cleansing away noxious matter by purgatives, amending secretion by alteratives, increasing tone by appropriate remedies, and having due regard to the suitableness of regimen.

The tendency of the simple sore, unless when over-stimulated either by accidental external injury or by malapraxis, is towards the second class, as already stated. And the prominent signs of change are to be found in the granulations, which become paler, taller, less sensitive, and vascular, overshooting the level of the surrounding skin; according to the common phrase, they are *exuberant.* This coming change is to be met by a corresponding alteration in the treatment; the water-dressing being medicated, so that, by its stimulant quality, vigor may be duly maintained in the part, and degeneration prevented.

When the process of cicatrization is by any cause long delayed, however, deterioration often does occur, in spite of our best efforts to the contrary. And so long as exuberant granulations remain above the surrounding level, no progress can be made; for unless the old skin and granulating surface be on the same level or nearly so, new cuticular formation does not advance. The exuberance must be brought down; and for this purpose many remedies are in use. Escharotics may be employed; nitrate of silver, or sulphate of copper. The effect, however, is painful; not always easily limited, so as to save the pellicle already formed; and not unlikely to be followed by over-excitement; undoing the granulating texture, by ulceration established afresh. Dry pressure is in all respects preferable; less painful; with ordinary care, easily limited to the part desired; and not likely to exceed in its effect on the vascular system. A portion of lint or charpie is neatly laid over the sprouting granulations; carefully avoiding the surrounding pellicle of new skin—therefore always rather too small than too large; and, if we wish to have the tender margins especially protected, we may cover them with thin pledgets of fine lint spread with simple wax ointment. This dressing is retained by a few turns of a bandage, not very tightly applied, however; for the intention is, not to induce vascular excitement sufficient to cause ulcerative disintegration, but merely to occasion absorption of the granulations, with a sthenic augmentation of vascular function around—far short of true inflammation. It is plain, therefore, that care is necessary, not only in adapting the compress, but also in applying the retentive bandage; lest either or both induce a greater result than is suited to the object in view. A few hours' use of a gentle compress will sometimes suffice. In all cases, the dressing should be early undone; that it may be desisted from so soon as the desired result has been obtained. Then—granulations and skin being once more on a level—the simple protective dressing is resumed; and cicatrization proceeds afresh. In certain situations, as the neck, the application of pressure may be inconvenient or altogether impracticable; and, under such circumstances, an eschar ntly.

This is usually the result ng; when, from any cause, local or constitutional, cicatrization has been delayed, and debility has usurped the place of sufficient repair. The granulations are larger and less numerous than in the healthy sore; much paler, of a faint pink, or yellowish hue; taller, not of a decidedly conical form, and bulbous rather than pointed at the apex; less firm, and as if dimly translucent; little sensitive, bearing to be rubbed almost with impunity; less vascular, emitting blood but sparingly unless rudely handled; and the blood which does flow has often more of the venous than of the arterial character. In truth they are imperfectly organized. The discharge is pale and thin, serum greatly predominating over the solid particles; there is but little fibrin, whether going to waste as pus, or going to repair as granulations. The general character of the surface is pale, flabby, and elevated above the surrounding integument. This latter is often the seat of passive congestion; and, sometimes, of a serous effusion following thereon. Consequently, it is of a blue or livid tint, soft, and somewhat swollen, though still below the level of the granulation. Often its free margin is overlaid by a bending over of the tall granulating mass; and the surface of the latter not unfrequently parts with the granulated character, becoming smooth and villous in its appearance.

Fig. 35.



The weak sore, of elevated surface. High granulations overlapping.

When the sore has been the seat of frequent change; ulcerating, because inflamed, one day; granulating well the second, and weakly on the third; the granulations coming and going, as it were—it is not uncommon for these variations to be succeeded by a permanently weak character of the ulcerated surface; and its integumental margins, having lost their support by the previous accessions of ulceration, are more or less inverted, as well as unusually dark from livid discoloration. This undermining and consequent inversion of the margin, is rather to be regarded as an accidental than as one of the ordinary characteristics of the weak sore. Sometimes, the undermining is extensive at one or more points; matter accumulates there, unless when removed by pressure; and a probe passes readily into the cavity, which is marked externally by swelling and blueness of the integument.

All, in short, evinces a want of sthenic function; and this may either depend upon local circumstances, as already shown, or be but one indication among others of a feeble system. No ulcer of large extent can escape degeneration into this form; it is the inevitable result of protracted cicatrization. A sore situated on the lower extremities—far from the centre of circulation, its venous return often if not habitually opposed, and all circumstances very favorable to passive congestion—is extremely prone to become weak. And, not unfrequently, such degeneration would seem to be connected with atmospheric influence. One day, the majority of ulcers in an hospital, or ward, may show a healthy character; next day, they may all be weak, or otherwise deteriorated, with no cause assignable, excepting perhaps the occurrence of a sudden, marked, and unfavorable atmospheric change. Repeated ulceration of the same part is a plain indication of debility there; and it need not surprise us to find that sores so produced invariably tend towards the weak character. Also, whenever the breach of surface has been originally caused by injury, which entails debility of the surrounding parts, that debility is certain soon to show itself in the sore; as after bruise and burn.

Treatment.—Prevention being better than cure, it will be our object to prevent decline from the healthy condition, if circumstances place this within our power. The granulations getting pale, tall, and changed both in form and number, we abandon the simple water-dressing, and have recourse to stimulants; gentle at first, lest over-excitement be induced. In avoiding one obstacle, we take care not to encounter another still more opposed to the healing process. The piece of lint, instead of being steeped in plain tepid water, is saturated with a solution of a stimulant nature, and reapplied in the ordinary way. Sulphate of zinc, nitrate of silver, sulphate of copper, creasote, chloride of soda, are some of the excitants more commonly employed. Of these, that which enjoys most general favor, and perhaps with justice, is the sulphate of zinc—in the form of lotion. This may consist of twelve grains of the sulphate of zinc, with two drachms of the compound spirit of lavender, and half a drachm of the spirit of rosemary, mixed in six ounces of water; but, of course, the flavoring ingredients may be varied in their proportions, to suit convenience or fancy. If the lotion smart much on its first application, it is to be diluted with tepid water; gradually diminishing the amount of this, in proportion as increase of stimulus is required. It is well, however, that we have a number of such remedies at our disposal. For, any one of them, used for a considerable period, loses its effect; and it is better, under such circumstances, to shift from one kind of lotion to another, than to increase the strength of the one originally employed. At the same sime, moderate bandaging is applied; by its mechanical support favoring venous return and a normal state of general circulation in the part; affording also the salutary stimulus of uniform gentle pressure; and preventing the occurrence of passive congestion—a sure forerunner, if not an attendant on debility.

The fulfilment of such indications, by bandaging, carefully employed, is also plainly applicable to the treatment of the first class of sore, when it has been long open, and threatens in consequence to pass into the weak state. A bandage, with medicated water-dressing, and due attention to the system, will in many cases succeed in maintaining the healing characters of the first class; thereby much abbreviating the process of healing. And thus we find the remedies suited to the cure of this second form of sore, to be the same as those which are calculated to prevent its occurrence; differing only in degree.

Recently, M. Malgaigne has proposed a new method of stimulating a weak sore. A piece of iron, such as a cautery, is heated to a white heat, and then held at [illegible]e from the sore; gradually approximating it, as the [illegible] will bear.[1] I have sometimes found this produc[illegible]tory amendment of the sore.

Ointments were at o[illegible]e in the treatment of ulcers, both of the simple and degen[illegible] but are now almost entirely superseded by the water-dressing, simple or medicated, which possesses all the good qualities of the other, without any of the actual and possible disadvantages.

Should the judicious use of stimulant lotions fail to repress the tendency to exuberance of granulation, they are to be for a short time superseded by the compress of dry lint (p. 211); and when the level has been thus restored—though often it may be well to continue the pressure, until the granulating surface is a little lower than the surrounding skin—their use is resumed. Under such circumstances, we seldom omit uniform and gentle bandaging; as an additional and well-adapted means of maintaining due energy of the part.

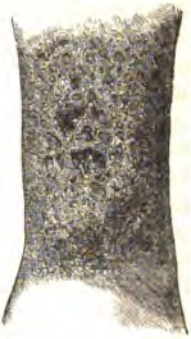
But local support is not alone sufficient. The general system requires our aid as well. Secretion and excretion having been found in order, or having been duly restored, nutritious regimen is enjoined; animal food, wine, malt liquors; given with a freedom proportioned to the power of digestion. And all sources of depressing influence are studiously avoided.

3. *The Scrofulous Sore.*

This class of ulcer is weak, almost from the first. For it is only one indication, among others, of a system not only decidedly weak, but of such debility as establishes a decidedly vicious or cachectic state—that of scrofula (p. 57). Such sores seldom occur singly, but in clusters. They are gregarious; at first distinct from each other, but ultimately becoming more or less confluent. The most frequent sites are the neck, shoulders, arms, hips, lower limbs—especially in the neighborhood of the articulations. The sores extend more in surface than in depth; yet their origin is not in the skin, as most other ulcers are, but in the subcutaneous areolar tissue. Commencement is made there by tubercular deposit; causing induration and enlargement, at first painless. Then perverted vascular function sets in, of a higher grade than the merely nutritive; and the consequences are pain in the infiltrated part, increase of swelling, and redness of the superimposed integument, with the other ordinary signs of chronic inflammatory progress. Imperfect suppuration takes place; and the swelling softens, and pits on pressure. By and by fluctuation is felt; and the fluid is seen through the skin, very much attenuated; but there is no regular pointing. Almost the whole of the integument over the suppurated and infiltrated part becomes thin, blue, and translucent; it gives way, partly by sloughing, partly by ulceration; and through the large, ragged, irregular aperture thus formed, thin pus, with broken down tubercular matter, and portions of sloughing areolar tissue, is discharged.

For some time, no effort is made towards reparation; on the contrary, the thinned and blue integument still further ulcerates, and the infiltrated tissue beneath oozes away in the discharge. The surface has no granulations, and is of a dirty gray hue; surrounded by a thin discolored skin, undermined, inverted, and floating loosely on the subjacent parts. After a time, some parts of the infiltrated tissue have been cleared away, by disintegration or sloughing; and there granulations begin to appear. But they are of the weak kind; tall, pale, and exuberant. A probe, used even with much gentleness, passes readily through granulations into the boggy texture beneath; causing little if any pain, and but slight effusion of blood. Or, following a superficial course, it finds integument undermined, and a ready communication so established from sore to sore. Around the cluster, there is usually a considerable amount of the products of ordinary chronic inflammation; serum and fibrinous exudation; the former much predominating. And this greatly increases the amount of general swelling, while it no doubt obstructs still further all salutary effort towards repair.

Fig. 36.



The scrofulous sore on the leg. Of the gregarious kind.

The system, originally in a bad state, is worse now: sympathizing much with the local disorder; and usually evincing, more or less intensely, the ordinary signs of constitutional irritation. At first, during the inflammatory and softening process, there may have been an effort towards sympathy of a sthenic kind; irritative fever, however, is more likely to occur than the inflammatory; and the ultimate result is usually a hectic.

Such sores, if left to themselves, sometimes skin over, at least in part; imperfect clearance of the tuberculated texture having probably been effected, by either ulceration or sloughing, or by both. But such cicatrix is very unstable, and certain to be undone at no distant period; dis-
g a state of matters beneath not in the slightest degree amended.
lue, soft, spongy, and elevated; whereas the true cicatrix is white,
and depressed. It is but as "the green mantle of the standing
which only for a time obscures the filthiness beneath.

sore which results from suppuration of a scrofulous gland has been
dy described (p. 53).

reatment.—It need hardly be said that the more important part of
is constitutional; attacking not one symptom of the disease, the

sore; but the disease itself, the scrofula. The nature of that treatment need not be here repeated (p. 56). Suffice it to say, that it must be steadily and patiently persevered in, not only during cure of the local affection, but long after; otherwise immunity from speedy relapse can never be expected. Indeed, the most difficult part of the treatment will invariably be found to consist in preventing return of the sores, but lately healed; resumption of the erect posture, exposure to cold, a blow, starvation, an excess in diet, too often suffice for early reproduction.

The local management requires to be energetic, and at first severe. Medicated lotions, ointments, poultices, will prove wholly unavailing in this class of sore. There is an unsound foundation for the reparative process; and that must [illegible] Potassa fusa, in solid substance, is inserted boldl[illegible]d tissue. If the skin have not already given way, [illegible] before this. And then the caustic is freely moved in [illegible]; so as to destroy thoroughly not only the areolar tissue [illegible]ed, but also the integuments where thinned, blue, undermined, and obviously incapable of recovery. Also, it is made to pass from sore to sore, subcutaneously; and, used somewhat as if a cutting instrument, it effects destruction of the intervening integument. Opening after opening is thus treated; until not only is each cleared of dead and dying textures—all these being, by the escharotic, at once converted into complete sphacelus—but the burrowing intercommunications are also freely exposed, and similarly freed from their unsound parts. It is, avowedly, a painful process, but most effectual; indeed, according to my experience, altogether indispensable towards obtaining a satisfactory cure.[1] Now, the pain need be only secondary, both as to time and intensity; anæsthesia being employed during the application. And thus the only serious objection to the procedure is obviated.

It should be done determinedly—rapidly yet carefully; and it is better to overtake the whole at once, than to temporize with partial instalments. The surrounding parts, during the operation, are protected by oil or vinegar; and afterwards, these protections are freely applied to the cauterized part, in order to assuage the pain, and prevent unnecessary extension of the escharotic effect. For we usually do not desist from the use of the potass, until tolerably certain that it has reached all the doomed texture; and but little increase of the immediate slough, therefore, is desirable. Dark, bloody discharge oozes out during the application; containing a considerable quantity of the escharotic in solution; and this is carefully and constantly wiped away, from the integument on which it comes. After such discharge has ceased, the whole part is covered with a poultice. And this dressing is continued until the slough has separated; disclosing a healthy granulating surface beneath—firm, red, vascular, and sensitive. Then water-dressing is assumed, and the local management afterwards conducted as for the first class of sore; into which the original affection has in truth been happily converted.

On separation of the slough, however, should the appearance of the subjacent part not be altogether satisfactory—from insufficiency of the escharotic application, or from renewal of tubercular deposit—more probably from the former—the potass is to be unhesitatingly reapplied; to such an extent as may be deemed necessary. Also, reapplication may come to be expedient—even after reparation has somewhat advanced. On the slough's separation, a healthy granulating surface may appear, and all go on favorably for a time; but first there comes delay, then arrest, and afterwards degeneration; the part threatening to return to its former unsound condition. Early use of the potass, to a comparatively limited extent, arrests the degeneration; and, in a few days, the reparative process is vigorously re-established. But in order to avoid such repetitions, as far as possible, let the first application be determined and complete; rather destroying too much than too little; and never, for a day, let the attention be diverted from constitutional management.

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[1] It is to be observed that it is *only* in the *scrofulous* sore—not in the cachectic—that this severe local treatment is advised.

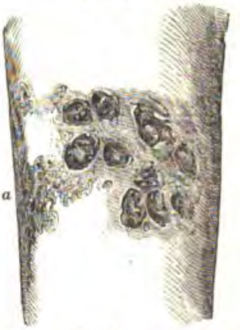
After cicatrization, it is to maintenance of general treatment that we must look for prevention of relapse; along with uniform support afforded to the part, more especially when this is in the lower linb. Bandaging is under such circumstances a most valuable means of prophylaxis; or, what is better, an elastic stocking; tight enough to support the limb, yet permitting freedom of muscular play and of venous circulation. And be it remembered that all cicatrices, more especially when extensive, and the result of sores defective in reparative power, require much protecting care; being, by reason of recent and imperfect organization, very liable to be undone by reaccession of ulceration.

4. *The Cachectic Sore.*

This, in many of its characters, resembles the preceding; but is not connected with subcutaneous tubercular deposit, or with scrofulous cachexy. The constitutional evil is of another kind; mercurial, syphilitic, or both.

The sore is most frequently found in the limbs; especially the lower; and the patients are adults. There is a plurality of openings; and subcutaneous communication may or may not exist. The ulcerous surfaces are usually of the weak character; but may be, incidentally, irritable or inflamed. The discharge is thin and serous; the surrounding skin is dusky, and slightly swollen; and often, in the near neighborhood, there are cicatrices, perhaps extensive, where similar sores had formerly been. Pain is considerable; the limb is wasted and weak; and the countenance wears the well-known expression constitutional evil which is the root and of the local malady.

Fig. 37.



The cachectic sore. At *a*, cicatrices of former ulceration seen.

atment is simple; and mainly constitu- The iodide of potassium is given in nd sustained doses; and ordinary stimu- reatment is applied to the weak sores. Under the internal remedy, amendment and cure often take place. But, once healed, the difficulty remains, as in the scrofulous sore—to prevent relapse. And to meet this indication, constitutional management is again paramount.

The principal points of difference between this and the preceding class of sore, are—the absence of tubercular deposit; the initiatory inflammatory process a simple one; the originating presence of the mercurial, syphilitic, or mercurio-syphilitic cachexy, instead of the strumous; and the absence of necessity for escharotic or otherwise active local treatment.

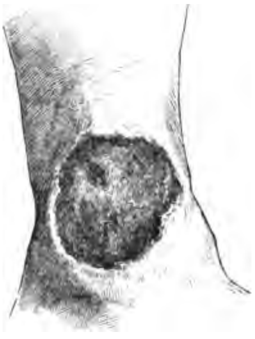
5. *The Indolent Sore.*

This, perhaps the most common of all ulcers, is most frequently found in the lower extremities, [illegible]hat advanced age. It is invariably of secondary fo[illegible]tion of confirmed deficiency in reparative power havin[illegible] state of matters widely different. The sore may ha[illegible]thy, then inflamed, perhaps thereafter irritable, then [illegible]ately indolent; merely in consequence of cicatrization having been often opposed and long delayed, by the situation or size of the sore, and by the accidents to which it has been exposed. A weak system is often found coexistent, and may have had some share in inducing the local apathy.

From what has just been said, it can be readily understood how such sores should be most frequently found in the legs of laboring men; so frequently indeed, as almost to render the indolent sore peculiar to that important class of the community.

The surface is excavated, smooth, glossy, pale, sometimes altogether void of granulation, sometimes sparsely studded by a feeble attempt at such formation. The discharge is thin and serous; containing but little fibrin; and the little which is exuded passes off, either in the form of pus, or as a flaky sero-purulent fluid. The surrounding integument is swollen, condensed, and discolored by passive congestion. That which constitutes the margin of the sore is much elevated above the raw surface; round, dense, white, callous. And in truth this is the most striking characteristic of the sore; which not unfrequently looks like a piece of pale mucous membrane, set in a dense and high ring of cartilage. It need hardly be said that such margins are not undermined, and neither everted nor inverted; but raised abruptly, a firm solid structure; the result of repeated accessions of the inflammatory process, of a low grade and chronic character. Both sore and margins are comparatively insensible.

Fig. 38.



The indolent sore, on the ankle. Usually the cutaneous margins are less irregular than in this instance.

But, usually, the sore does not present the characters just enumerated, when first brought under our notice. So long as it is merely an indolent ulcer, the patient suffers little pain or other uneasiness; and continues his wonted avocations. But he receives a blow on the part; or is exposed to wet and cold, or other exciting cause of the inflammatory process. Inflammation is induced, in and around the sore; he can work no longer; the erect position, even, is difficult; and he then applies for relief. Under such circumstances, the ordinary characters of the indolent class are seen, as it were, through an inflammatory medium. The surrounding skin is red, more swollen, painful; and even the callous margins are colored. The raw surface is still low, and void of granulation, but red and softening. The discharge is still thin; but bloody, and mixed with more or less disintegrated texture; for ulceration is soon re-established. By and by, the part, being low in power, is overborne by the inflammation; the margins, as well as the surface of the sore, become converted into a slough; and, as such, are gradually detached. On separation of the slough, we expect to find a healthy surface beneath; so soon as the inflammatory and ulcerative processes shall have subsided.

The Mucous Sore, of some authors, is usually a variety of the indolent class; in which the raw surface, by reason of long persistence, has been thoroughly converted into a resemblance of mucous tissue; pale-red, smooth, and villous; shining, as if varnished; with a limpid quasi-mucous discharge. Or a weak sore, without assuming much of the indolent character, may degenerate into a mucous-looking surface; as after wound.

Treatment of the Indolent Class of Sores.—As just stated, the part is usually presented in an inflamed state. The patient is put to bed, and a poultice is applied to the sore and its vicinity. The tongue will be found heavily coated; and other plain indications of great derangement in the primæ viæ will not be wanting. An active purge, repeated if necessary, is therefore highly expedient. Low diet is enjoined; and if this, with action on the bowels, be not quite equal to allay the inflammatory fever, which is likely to be more or less developed, aconite or antimony may be also exhibited. Thus, in a day or two, a cleansing of the sore is obtained; that is, the slough, having become completed, separates by ulceration; the inflammatory process subsides from the suppurative and ulcerative grades; and remains in a more subdued form, favorable to plastic effort. Consequently, on detachment of the slough, a healthy surface is usually found beneath; demanding the class of treatment suitable to the first class of sore.

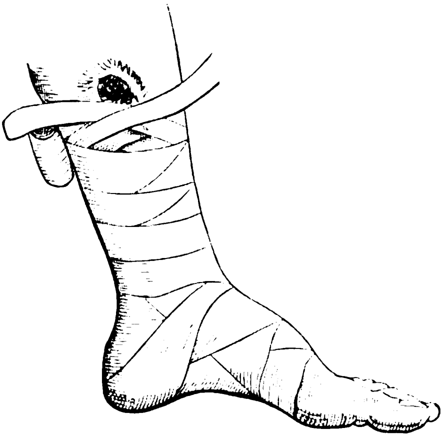
When the sore is presented in the simply indolent state, two modes of treatment are in our option. *First*, we may imitate the process whereby Nature rids the part of its incubus; by induction of the inflammatory process. This may only induce ulceration of the previously callous surface; giving the granulating condition, on subsidence of the inflammatory. Or, by going a step further, it may more closely imitate Nature; converting all the parts which evince indolent character into a
and leaving the work of repair to follow on that slough's separa-
For this purpose, a blister is probably the most convenient stimu-
Usually, it is applied so as to produce the major effect; and, after
quisite amount of inflammation has been induced, the treatment
same as that already advised under similar circumstances of spon-
s origin.

only objection to this mode of treatment is, that it is painful;

and brings some hazard of inducing more excitement, as regards both extent and intensity, than is at all desirable. For, be it remembered, both part and system are usually in such a state, as to be both prone to assumption of the inflammatory process, and unfavorable to its control. We may seldom fail thus to change the character of the sore; but occasionally—perhaps not unfrequently—it may be at the cost of establishing a worse disease, erysipelas. Besides, even supposing that such accident do not ensue, undoubtedly the first effect is to enlarge the raw surface; it is a larger, though a better sore that we obtain; and it is not improbable that ere that wide space can be brought entirely to close, it may have degenerated, in spite of our best efforts to the contrary, into the weak, or perha [illegible] he indolent form. On the whole, therefore, as a g [illegible] other mode of treatment seems preferable.

Second.—By continua [illegible] unding elevation is undone, and the villous surface chang [illegible] lating sore. The first part of the manipulations is to support the whole limb, below the ulcerated point, by moderate and uniform bandaging. If this be neglected, congestion must ensue; and more serious consequences are not unlikely to follow thereon. Then a strip of common adhesive plaster, about one inch in breadth, is applied with tolerable tightness over the lower part of the sore; crossing the ends over this, the centre of the strip having been applied to the opposite point of the limb. Plaster after plaster is thus adjusted, until we have invested not only the whole ulcerated surface, but also a little of the unbroken skin both above and below. And when the sore is large and its discharge profuse, a slit may be made in each strap, where it crosses over the ulcer, in order to prevent purulent accumulation. The bandaging, which had stopped to permit application of the plaster, is then continued; covering the whole limb, from the very distal extremity, to about a handbreadth above the seat of ulcer. The limb is then placed in an elevated position; and, for some hours, this, as well as the general recumbent posture, are very strictly maintained. A feeling of constriction, sometimes amounting to actual pain, is usually complained of; but seldom lasts long; and still more rarely does it, by persistence, render an undoing of the dressing necessary. It is met by rest, and elevation of the part; or should these fail, affusion of cold water will suffice to restore comfort.

Fig. 39.



Strapping of the indolent ulcer shown.

After two days—not earlier, unless symptoms of inordinate vascular excitement have manifested themselves—the bandage is undone. A grooved director is insinuated beneath the plaster, at the point opposite to the ulcer; and on this the strap is cut. The dressing is then gently removed; and, according to the change which has been effected in the sore, is the same dressing repeated, or another substituted more suited to the characters which the sore now presents. Often, after but two dressings by strap, the ulcer is found to have parted with all indolent character, and to have assumed that of the healing sore.

By the continued pressure on the callous margins, absorption is instituted there—partly interstitial, partly continuous; and thus they are gradually brought down from their undue exaltation of level. By the same agent, acting on the villous surface, this is broken up by disintegration. For, pressure which only causes absorption, in an unbroken part, is equal to the induction of ulceration in that which is deprived of integumental protection. By and by, this destructive process ceases; the part becoming habituated to the stimulus, which is gradually diminished by a yielding of the dressing. Granulation succeeds; and thus, the raw surface mounting up, while the surrounding integument is descending, an equal level requisite for cicatrization is gradually approached.

The stimulus continues to act on both the skin and sore; causing absorption in the one, and maintaining vigor of vascular function in the other. As formerly explained (p. 113), pressure, in a slight dose, excites absorption chiefly; in a greater, it arouses vascular function of a sthenic kind, short of true inflammation; while a still larger dose reaches the true inflammatory acme, bringing suppuration and ulceration. Here the same dose is applied to both margins and sore; but the latter is less tolerant than the former; and in regard to the latter the same pressure is practically equal to a higher dose, than that which is operating on the margin. Hence we have only absorption in the one; and, in the other, vascular excitement of a sthenic type.

Besides, the mechanical effect of the circular band is to draw together the sound parts on the sore; and thus greatly to favor not the least important portion of the cicatrizing process—namely, centripetal movement of the original tissues (p. 178).

Sometimes, when the edges are very high, and the sore deep and small, the plaster reaches only the margins at first; the raw surface escaping by their interposition. A certain amount of salutary stimulus is nevertheless conveyed to the latter; and, on subsidence of the skin, pressure comes to act on both in the usual manner.

In all cases, it is very apparent—in regard to the effect on the raw surface—that the amount of pressure must be carefully regulated; at first tolerably severe, to induce absorption and disintegration; afterwards more moderate, lest vascular excitement be overdone, and reparative effort on the raw surface be opposed rather than advanced—much in the same way as we found it advisable to regulate pressure, and gradually diminish its amount, in the treatment of sinus (p. 198). At first we want change of structure, and an aroused function; afterwards a maintenance of function, neither too high nor too low, but sufficient for the purpose of progressive repair.

The dangers plainly are over-excitement, and strangulation of the limb; even although the latter be provided against, by previous careful bandaging. Both may be prevented by a very simple proceeding; making a section of the mass of plaster, after it has firmed on the part, on a grooved director introduced at the point opposite to the sore. This is sufficient to relieve constriction, and to moderate pressure; the beneficial effects of the latter are not foregone, while danger is obviated; and besides, resilience of the plaster, to the opposite point from that which is cut, plainly augments the important centripetal action of the integument and areolar tissue around the sore. This modification, therefore, apparently of a trifling and perhaps detracting nature, may be in truth an important and corrob[illegible] the manipulation; not always necessary; but us[illegible] in which intolerance of the ordinary pressure may i[illegible]t. The strap, having been firmly applied, is allowe[illegible] consolidate, and tightly to embrace the limb; and t[illegible]ade.

Another advantage of this [illegible] treatment is, that although more progress is likely to be made in the recumbent posture, yet it is not essential that this should be uniformly maintained. For a few hours after adjustment of the dressing, rest is indispensable; but afterwards the erect posture may be resumed, and wonted avocations therewith—a point often of much consequence to the patient. Such resumption may delay the cure, but will not always prevent it.

Sometimes this mode of dressing may be continued; on almost each occasion less tightly applied. But, as already stated, the character of the sore often changes so decidedly for the better, after one or two applications, as to call for corresponding change of treatment to the simple dressing as for the simple and healthy sore.

Lately it has been proposed to cover the whole limb, from the distal extremity to beyond the ulcer, by plaster; either the common adhesive kind, or thicker, and spread on leather. To this there seems to be no valid objection; save on the score of expense and trouble. At the same time, it is obvious that the ordinary use of strap and bandaging will fulfil precisely the same ends, if carefully and properly applied.

Throughout the cure, the system is duly attended to. The diet is generous; and it may be that tonics, and even stimuli, become expedient. For little good can be expected to follow the most skilful treatment of the part, unless the general frame be provided with sufficient power to maintain the work of repair. Among other internal stimuli, turpentine has been found very useful. And, in the opinion of some, small doses of opium—half a grain night and morning—are of service, in maintaining energy of the capillary circulation, more especially when the patient is advanced in years.

After cicatrization, local support, by bandaging or an elastic stocking, is not to be omitted; otherwise relapse is but too probable. A small circular aperture appears near the centre of the cicatrix, as if made by a pin's point; this rapidly enlarges; and the sore may assume the characters either again of the indolent, or of some other variety

6. *The Irritable Sore.*

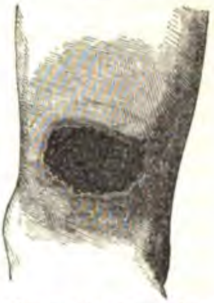


Fig. 40.

The irritable ulcer; dark; almost passing into the phagedenic.

This is an example of Irritation supervening on the products of Inflammation; usually of secondary occurrence; and the result of accident, of malapraxis, or of a depraved state of system. The sore is almost invariably superficial; not penetrating more deeply than the true skin. In fact, this texture may be said to be the peculiar site of this class of ulcer; and the circumstance may in part account for the great sensibility of the sore. The surface is unequal; deeper at some points than others. It is void of granulation; and either of an angry, dark-red, fleshy hue, or covered with a grayish film of tenacious, aplastic fibrin. Sometimes this covering only partially invests the surface; which then shows both the red and gray appearances. The edges are thin, serrated, and everted; of a red, angry color; and sometimes studded with brightly florid points, as if of arterial blood. The surrounding skin is slightly swollen, and also of a dull red color; being in a state of passive congestion; or, perhaps rather, not yet recovered from the chronic inflammatory process. Discharge is thin, acrid, bloody; often mingled with solid matter—either recently exuded, or the result of disintegration in the primary textures. Pain is constant; always considerable, often excessive. The slightest interference with the acutely sensible surface is followed by a feeling of intense burning, and by a copious flow of blood, usually of a dark grumous character; as if the injury were resented, instead of being merely acknowledged, as in the healthy sore. Generally, an irritable state of system precedes and accompanies this state of the part; and even when no such predisposition exists, that morbid condition of system is almost certain to occur—an example of constitutional induced by local irritation. Along with the ordinary symptoms of the constitutional form—more especially restlessness, want of sleep, loss of appetite, emaciation, and general disorder of secretion—there is often a remarkable peevishness of temper unhappily combined.

This kind of sore is liable to occur anywhere, on the surface; more especially if it follow on eruption, as it very frequently does. But its most common locality is on the lower limbs; on the shin, and near or over the ankle. It is not unlikely to pass into the next class of ulcer; an example of what is not unfrequent—Irritation inducing Inflammation.

Treatment.—This is partly, and often mainly, constitutional. The [illegible]sing, if not the exciting cause, is in many cases found in the [illegible], and must be opposed by the suitable remedies. With this vi[illegible]he primæ viæ and general secretion will especially claim our attentive regard. In other respects, the treatment suitable to constitutional irritation is maintained, along with local management. This latter consists in rest, elevation, and relaxation of the part; and such applications as we formerly saw to be most advisable in cases of irritation (p. 77).

Of these, none are so generally useful as the nitrate of silver; applied lightly to the raw surface; but with some intensity to the margins, so as to produce a slightly escharotic effect there, and bring them into a form more suitable for the commencement of cicatrization; and pencilled, still lightly, over the surrounding skin, where swollen and discolored—so as merely to blacken this, and obtain the sedative and purely antiphlogistic effect (p. 157). A temporary increase of pain usually follows, in the sore; but soon passes away, on the application of a soft light poultice, or hot-water dressing. And this epithem is continued until reapplication of the nitrate; which may be daily, or only on each alternate day, according to the effect produced.

Under this treatment, [illegible]en rapid and satisfactory; pain diminishing, and soo[illegible]dinate; the margins losing their irritable character[illegible] surface beginning to be studded with healthy gra[illegible]rdinary simple treatment is assumed (p. 209). But suc[illegible]able. Pain may be permanently increased by the application; and the sore either becomes more and more irritable, or threatens to pass into the inflamed. In such circumstances, more simple sedative means must be applied to the sore; pencilling by nitrate of silver being still continued, however, to the surrounding integument. An aqueous solution of opium may be used, five grains to the ounce; or conium, hyoscyamus, belladonna, hydrocyanic acid, or aconite, cautiously; and sometimes good effects are produced by a weak nitric-acid lotion—from two to five drops to the ounce of distilled water.

When the sore is secondary to cutaneous eruption, a weak solution of arsenic is often very beneficial; and, in such cases, it is well to combine the internal with the local use of this remedy. But, in my opinion, neither arsenic nor nitric acid are suitable as early applications to this kind of sore. They are apt to stimulate instead of soothing; and probably should rather be employed as alteratives, after the characters of the sore have been somewhat modified by the previous use of more appropriate, because more truly sedative remedies. If even these fail to relieve, benefit will sometimes follow continued exposure of the part to the steam of hot water; of as high a temperature as can be conveniently borne.

Should light application of the nitrate of silver fail to remove congestion from the surrounding skin, leeches or punctures may sometimes, though rarely, be required.

On the whole, as already stated, the most trustworthy and generally applicable local remedy is the nitrate of silver. Used not oftener than daily; and, usually, but once in the forty-eight hours. Applied with great lightness, to the raw surface and surrounding skin; so as only to produce its slightest effect—the very opposite of escharotic—sedative, anodyne, and protective, by the formation of an investing pellicle on the sore. Pressed firmly only on the margins; and they too but tenderly dealt with, so soon as they have undergone a favorable change.

But, whatever be the local management, let it never be forgotten that an indispensable, and often by far the most important part of the treatment, consists in remedies directed to the system. If this be neglected, no local application will be of any permanent avail. The ulcer in most cases has sprung from, and is maintained by, an evil state of constitution, and only by eradication of that origin and maintenance, can it be removed.

7. *The Inflamed Sore.*

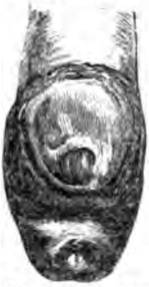
This presents the ordinary characters of advancing ulceration, with accompanying inflammatory progress; and as can be readily understood, is the most common original form of ulcer. Very often, however, it is of secondary occurrence; for, over-stimulation is not unlikely to happen in the treatment of ulcers of a healthy, or even of a sluggish kind. The raw surface is gradually disintegrating; and, instead of contracting, steadily enlarges; showing no granulations, but a soft, raw, pulpy substance; and emitting a profuse ill-formed pus, mingled with the ulcerative *debris*. The margins are swollen, red, hot, tense, and painful; and so is the surrounding integument. The erect posture and motion increase the pain; the system is more or less involved, in febrile disturbance of the inflammatory type; and the primæ viæ are usually detected in marked disorder. Not unfrequently, the inflammation running high, while local power is weak, sloughing takes place, more or less extensively; as already noticed in regard to inflammation supervening on the Indolent variety of sore (p. 218).

Treatment consists in moderate antiphlogistics. Rest, relaxation, elevated position, fomentation, poultice, hot-water dressing, antiphlogistic regimen, purgatives, aconite, or antimonials. Sometimes it is necessary to draw blood locally; and this may be done by leeches or punctures. The former are sometimes placed on the sore itself, with good effect. And this practice may also, occasionally, prove beneficial in the irritable sore—when following the inflamed, and surrounded by considerable and somewhat active congestion. Punctures are preferable, however, in the integument. For leeches there are apt, by their own irritation, to induce spreading of the inflammatory process, of an erysipelatous kind; or the bites may themselves assume ulcerative action, and so extend the original disease (p. 147). Let not antiphlogistics, however, even when moderate, be continued one moment longer than is absolutely necessary; otherwise degeneration into the weak sore is speedy and certain. Let it be always remembered, that a part once truly inflamed, is ever after defective in vital power.

8. *The Sloughing Sore.*

This differs from the sloughing state which not unfrequently affects the simple inflamed sore, in being not casual and temporary, but an inherent characteristic of the disease. It usually begins with the formation of a slough; and continues to enlarge, by repetition of the same process; the result of local vascular excitement, occurring not only in a part but in a system of diminished power. Such morbid change is in itself not great, and in a sound texture would probably lead to no higher result than simple exudation; but in a worn frame and weak part, vital power is almost instantly overborne; and almost the first indication of the inflammation's presence is supersedence of vital by chemical change. Thus the inflammatory process instituted in the sexual organs of ill-clothed, ill-fed, intemperate prostitutes, living in the densest and filthiest parts of dense and filthy cities, is very apt to produce this kind of sore. Here local and general debility exists, before application of the exciting cause. But the relation may be reversed. The cause may be capable of exerting such a depressing influence on both system and part, rapidly, that the inflammatory process which it excites very speedily terminates in gangrene; as happens in inoculation of certain poisons—that of venomous snakes, for example, or of diseased animals.

Fig. 41.



The sloughing sore, as affecting the penis. The prepuce almost gone; the glans going.—ACTON.

Or the inflammatory process may itself induce a change in the part affected; inimical to power, and favorable [illegible] of inflammation. Thus, a sore on [illegible] of a simply acute nature; paraphim[illegible] sequence of the surrounding inflamm[illegible] change of relative position is neglected; consolidation takes place; and then attempts at reduction are unsuccessful. The constriction is neither so great nor so complete, as to produce sphacelus of the whole glans; but it is sufficient to establish slough after slough on the breach of surface. And this is an example of what may be termed the secondary sloughing sore; not commencing with a slough; but an ulcer, passing into that condition, and remaining so degenerated.

The originating slough is sometimes dry, sometimes moist; according to the rapidity with which the destructive process has advanced. Usually, great humidity is one of the most characteristic features of the sore. When dry, the case may be termed a chronic form of the disease; by far the less frequent in occurrence. Sometimes, after a dry commencement has been made, rapid transition takes place into the humid form, accompanied with great pain; the discharge commencing when the first slough begins to separate, and soon becoming profuse. Whatever may have been the previous state of system, there is soon much constitutional irritation; and, at the same time, the primæ viæ—by loaded tongue, fetid breath, &c.—generally indicate very prominent disorder. Not unfrequently—as in the malignant pustule—a vesicular or pustular condition of the surface briefly precedes actual death of the part.

A superficial slough having fairly formed, it begins to be detached. Its edges loosen, and expose the subjacent parts; but these, instead of showing the red fleshy granulations of repair, or even the angry aspect of advancing ulceration, disclose but a new formation of slough, soft and tawny. And thus gangrene upon gangrene may succeed—in strata, as it were—until the part has been frightfully mutilated, and the system brought into most alarming disorder. The surface is generally of an ashy hue; sometimes inflated by extricated gases; sometimes darkened by commixture with a grumous bloody serum. The discharge is thin, fetid, sanious; usually very profuse, giving the characteristic humidity; and mingled with putrid solids, partially dissolved. Not unfrequently, hemorrhage takes place; profuse; arterial or venous, more frequently the former; the sloughing, unpreceded by interstitial and plastic deposit, having opened a vessel of considerable size and activity. The result of this bleeding is sometimes beneficial; sometimes highly hazardous. The former, if it affect only the part; critically resolving the action. The latter, if it affects not only the part but the system; depressing still further the powers of life, which are already too low. Fatal results, from this cause, have not been unfrequent.

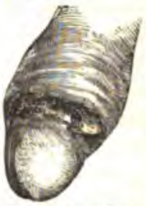
There is every reason to believe that this form of malady is contagious; that the secretion from a sore of this kind, applied to a healthy ulcer, or perhaps even to an unbroken portion of skin, may induce a state similar to the original.

9. *The Phagedenic Sore.*

This is a spreading ulcer; destruction advancing more determinedly than in simple ulceration, however acute; but still by molecules; not by masses, as in sloughing. It results from a somewhat similar conjunction of circumstances with the preceding; local excitement exceeding local power, and usually attended with debility, as well as irritability of the system. Two forms occur; the acute and chronic.

The acute is usually a sore of irregular form; with margins abrupt and somewhat ragged. And these, as well as the integument to some distance around, are red and slightly swollen; being affected by a minor amount of the acute inflammatory process. There is a sensation of sharp burning heat in the part. The raw surface is of a brownish hue, totally void of anything like granulations, of uneven depth, and in many places presenting the appearance as if gnawed by the teeth of a small animal. The system suffers severely; and the form of its disorder is that of constitutional irritation (p. 78).

Fig. 42.



Acute phagedena, burrowing beneath the integuments of the penis.—Acton.

The chronic variety is less painful, less inflamed, less rapid, darker in hue, with the gnawed appearance usually more distinct; commonly surrounded by considerable induration, and often spreading at one aspect, while slowly cicatrizing at the opposite. If several sores exist, all usually extend in the same direction. Withal, the constitutional disturbance is less severe.

10. *The Sloughing Phagedena.*

The acute phagedenic sore seldom persists in a distinct form. Much more frequently, it is associated with the sloughing; constituting *Sloughing Phagedena.* Commencement may be made by either. If phagedena have preceded, the sore becomes lighter in color, with margins less distinct, temporary diminution of discharge, and perhaps a lull in the pain. A thin slough forms. This begins to separate; discharge again becomes profuse; and, on separation having somewhat advanced, either a second slough is seen being formed, or the part is found yielding before reaccession of phagedena. Sometimes, the alternation of slough and ulcer is tolerably regular; in other cases, one or other form of destruction may have the predominance.

Constitutional disturbance is at least equally severe, as in either the sloughing sore or acute phagedena, uncombined. Indeed, very frequently both part and system suffer more in the combined form, than in either singly. The combined is less frequently original, than either of the separate forms.

Familiar examples of the sloughing ulcer are—the Malignant pustule, and the sloughing sore of the penis; of the phagedenic, lupus of the face, and the phagedenic form of venereal disease; of the sloughing phagedena, Hospital gangrene or sore, and Cancrum oris. In all these varieties, but more especially the last, discharge is remarkably fetid, as well as profuse. And the fetor is so strikingly peculiar as to constitute one of the most prominent characters of the disease; poisoning thoroughly the atmosphere [illegible]ment, and felt oppressive at a considerable distance.

Treatment.—The tre[illegible]ee classes, being in most respects identical, has bee[illegible]. It is both constitutional and local. The primæ viæ almost [illegible]y showing signs of oppression, a purgative, not over active, is exhibited. And some antimonial may be at the same time given; should there seem any effort towards a sthenic form, in the constitutional disorder. If there be, it will only be at the commencement; for very soon Irritation is the decided type. When the tongue begins to clean, and the patient looks lightened by the evacuation, then the treatment peculiar to constitutional irritation should come into play. And the best medicine, perhaps, under such circumstances, is Dover's powder; in doses of ten grains, or thereby, given three times a day. It relieves the secretions, assuages local pain and general irritation, brings down the pulse, gives sleep, and obviously exerts a most beneficial influence on the local disease. And should this, by its persistence, demand repetition of painful remedies, it is well to give an additional dose of the powder at each such repetition; to allay pain, and prevent general irritation from being reinduced. Atmospheric influence should also be attended to. In many cases—more especially when this form of sore is of secondary accession—this would seem to be the predisposing, if not the exciting cause of the disease. And whenever circumstances give rise to such suspicion, the patient ought of course to be carefully excluded, as much as possible, from the operation of such untoward agency. The diet should be good, yet non-stimulant; and in the first instance, at all events, restriction to the farinacea will be expedient.

As to local management, surgeons are not quite agreed. One party advocate the most lenient measures—poulticing, rest, and expectancy; while another are in favor of severe and active remedies—escharotics—at the outset; in order to cut short the disease, and—along with suitable constitutional treatment—to change the character of the sore into the healing type. Among the latter I would have myself enrolled; and simply because experience of both gives, to my perception, a decided superiority to the energetic over the expectant system. One reason why some have lost faith in active remedies, I believe to be, that these have not been efficiently applied. Great humidity has been already stated to be a prominent characteristic of the majority of such sores. An escharotic, applied to the parts unprepared, proves almost inert; for it is dissolved by the fluids, and passes off after having but grazed the solids. The first, and a most essential, part of the manipulation is, to dry the surface and parts around thoroughly; by tow or lint, gently yet firmly applied. At the same time, loose sloughs are taken away, and the thickness of adherent dead parts is diminished, by scissors. Thus, and thus only, is the sore prepared to be duly affected by escharotics.

Of these, two are most in favor; nitric acid, undiluted; and an acid solution of the nitrate of peroxide of mercury. The former seems the more adapted for general use; and is certainly preferable for the first application; being equally effectual in forming an immediate and sufficient eschar, and followed by considerably less protracted pain. A flat piece of wood, or a director wrapped round at the extremity with lint, is soaked in the acid; and then pressed firmly on every part of the affected surface, as well as on the yet living margins. And the application is continued, until all has been converted into eschar; protecting the surrounding integument by carefully wiping up the fluid product. Or the acid may be applied in the solid form. When highly concentrated, and gradually dropped upon lint placed on an earthen vessel, a gelatinous paste results; and this exerts an escharotic effect on the parts with which it is brought in contact, proportioned in degree to the time of its application.[1] The part is then covered by a soft warm poultice; and this application is continued until the eschar begins to separate, when it may be conveniently superseded by warm water-dressing. Not unfrequently, this may be advantageously medicated by solutions of the chlorides of lime or soda; as correctives of fetor, and detergents.

So soon as detachment has begun, a careful and anxious examination is made of the subjacent part; more especially at the very margin; in order to ascertain whether the sloughing tendency has been arrested or not. If it has, a healthy surface will be found, either simply ulcerating, or already showing signs of repair by granulation; and simple water-dressing is continued. If it has not, the ash-colored slough will be found again forming; or rapid destruction is seen advancing, in the phagedenic form. And then the escharotic must be at once and freely repeated; directing its operation chiefly to the margins, as there the chief tendency to extension of the evil would seem to reside. If need be, such repetition is continued, until the destructive process has been finally and fully controlled.

In the reapplications, nitric acid may be well superseded by the nitrate of mercury; not as a more efficient escharotic, but as a more successful *alterative* of the sore. It is liable to but one objection, namely, that a burning pain is not unlikely to continue for several hours. This is in part obviated, however, by simultaneous exhibition of the internal sedative and anodyne, as formerly advised (p. 228); or chloroform may be used, as a more thorough anæsthetic. It has been alleged that ptyalism has inconveniently followed such use of this escharotic; but the examples in proof seem very doubtful. The sore, in all probability, is too acutely inflamed, to admit of much absorption from its surface (p. 99).

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[1] Lancet, No. 1370, p. 578.

Whatever caustic is used, in no instance should preparatory drying of the part be omitted; it is as necessary in the last application, as in the first. Be it likewise remembered, that this class of sore is communicable by contagion; that, consequently, much personal cleanliness is demanded towards each patient; and that, in hospital practice, all community of dressings, and every other circumstance likely to effect conveyance of the contagious matter, must be scrupulously avoided.

On arrest, even partial, of the sloughing and phagedenic processes, by local treatment, the constitutional symptoms undergo a marked improvement. For, the effect of the escharotic is not merely to convert both dead and dying parts at once into an eschar; but also, to oppose constitutional contami[illegible] of deleterious matter, both fluid and gaseous. A [illegible] mass, is changed into one which is comparatively [illegible] at the same time, there is established a sthenic i[illegible]rative process, for the dead part's separation, in the comparatively sound texture immediately beyond—a process unfavorable to absorption. When sloughing has ceased, when the sloughs are almost separated, and when granulation is fairly established—the characteristic humidity, fetor, and pain, all gone—the febrile disorder will be invariably found to have greatly subsided. Then tonics and generous diet have become expedient, to allay the hectic tendency, and maintain constitutional power sufficient for local repair.

Such being the treatment most suitable to this class of sores, it is very obvious how important it must be, in all cases, to diagnose accurately between what is really of this nature, and mere simulation of it by accidental sloughing in the simply inflamed ulcer; the one requiring a painful escharotic, with the treatment suitable to constitutional irritation; the other, merely continuance of bland poulticing, with moderate antiphlogistics.

It need scarcely be added, that in no instance of the genuine form is bloodletting advisable. As already seen, local loss of blood sometimes occurs in the progress of the disease; occasionally for good, but perhaps more frequently for evil. In all circumstances, it is certainly an event of hazard; with a leaning to the side of evil, sufficient to forbid its rash institution by the practitioner.

Mercury, too, is not to be thought of. As a general rule, in sloughing and phagedenic sores, more especially when of venereal origin, mercurial medicines are always to be withheld; as certain to prove more or less pernicious—in many cases disastrously so. They aggravate the disease; and, indeed, supervention of the constitutional disorder attendant on mercurial exhibition, is often the cause of comparatively healthy sores degenerating into the sloughing or phagedenic forms.

Escharotics, it will be observed, have been spoken of as applicable only to the scrofulous, sloughing, and phagedenic sores. But in some cases both of weak and irritable ulcers, especially when attendant on marked constitutional disorder—should the unhealthy characters obstinately remain perverse, notwithstanding due perseverance in the ordinary mode of treatment—escharotic destruction of the irretrievably diseased parts may be effected; with a good hope of finding, on separation of the slough, a sound foundation for repair.

Peculiarities of Ulcers.

1. Many sores on the lower extremities are accompanied, or rather caused by, a varicose condition of the veins; and by some the "*Varicose Ulcer*" is entered into the general classification. But, in truth, this term does not express any individual kind; but rather comprehends every variety of sore. For all, or almost all, may be attended by, and partly result from, a varicose condition of the veins. The irritable is very common, under such circumstances; so is the inflamed. The indolent and weak, especially the former, are said by some to be the most frequent types of the varicose ulcer; but, according to my experience, neither are more common than the irritable. Occasionally, the scrofulous is found complicated with varix. We may have even the sloughing and phagedenic; and, in that case, profuse venous hemorrhage is to be expected and guarded against. Perhaps the least frequent form is the healthy sore; as can be easily understood, when it is remembered that varix and passive congestion are all but synonymous; and that this state is very unfavorable to all sthenic and salutary inflammatory change.

Treatment will necessarily vary according to the character of the sore, independently of the varicose complication; poulticing and rest to the inflamed, stimulants to the weak, nitrate of silver to the irritable, straps to the indolent, &c. But, besides, it is of course essential to deal with the obvious predisposing cause, the varix. If this be great and of long standing, and have induced oft-repeated ulceration of a troublesome and grievous nature, the radical cure ought certainly to be attempted; in the way which will be explained, when speaking of the treatment of that disease. But as this requires confinement for some time, and is not altogether void of danger, in the slighter and more ordinary cases the prudent surgeon contents himself with palliative management. That is, rest and recumbency during the ulcerating and healing processes; and uniform support, from bandaging or elastic stocking, both then and subsequently. Even during the acutely ulcerating, and in the phagedenic form of sore, a certain degree of support is advisable—slight, uniform, and never amounting to direct pressure on the raw surface; in order to obviate accidents by the sudden occurrence of hemorrhage. At the same time, much attention is paid to the lower bowels; keeping them clear of obstruction; and thereby removing a cause, not more obvious than common, of both occurrence and continuance of varix in the lower limbs.

2. The lodgment of *foreign matter* may complicate an ulcer; effectually preventing cicatrization. This may have come from without, consisting of wood, stone, iron, cloth, &c.; by impaction, originally causing inflammation and abscess; and then, by delaying contraction of the open suppuration, establishing the condition of ulcer (p. 198). Or it may have an internal origin; consisting of necrosed bone, dead tendon, or ordinary slough of fascia or areolar tissue; the result of suppuration, either then or previously. Of whatever nature, and whencesoever come, the foreign body is always amenable to but one treatment—early and complete removal. Some little excitement follows the manipulation necessary to effect that object; and is to be met by rest,

fomentation, poultice, and other usual antiphlogistics. On subsidence, the granulating process begins; and is conducted under the ordinary treatment.

3. *The Sinuous Ulcer.*—Sinus may coexist with ulcer; preceding or accompanying. If it fill not up and contract spontaneously, keeping pace with the corresponding change in the sore, it is to be treated independently. Pressure, in the first instance, is applied; direct, and regulated according to the principles formerly inculcated (p. 198). If this fail, then the sinus—usually superficial—is to be laid open; either by knife, or by potass, as circumstances may render expedient.

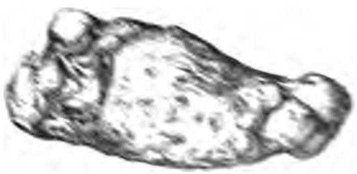
If the term sinus be applied to the undermining of integument, and unsoundness of areolar tissue, which invariably characterize the scrofulous sore, then the us[illegible] will be invariable; for the reasons formerly given ([illegible]

4. *The Pustular So*[illegible]ruption of pustules, or vesicles soon becoming pur[illegible] some part of the surface of a limb; and on the pustules g[illegible], [illegible] ulceration continues. The sores, at first inflamed, may become irrita[illegible]le. Often they pass early into the weak form; not, however, before the previously active stage has diminished, or in some parts altogether effaced, the inter-ulcerous patches of skin. These, on inflammation subsiding, assume the work of cicatrization; and proceed lazily and imperfectly in the formation of new integument. If healing be long delayed, the insular portions of skin thicken, and rise in the edges; and the character of Indolent sores may be more or less completely assumed.

This variety of ulcer, in some respects, resembles the scrofulous and cachectic sores. But it differs from both; in the absence of tubercular deposit, and of unhealthy inflammation in the inter-ulcerous texture; and in the absence of any constitutional evil, other than what may be termed common derangements of the general health. Perhaps, in its early stage, at least, it were more naturally ranged among Eruptions than among Sores.

Treatment varies according to the aspect of the part: sometimes water-dressing; sometimes nitrate of silver; sometimes stimulant lotions; sometimes strapping. After cicatrization, rest, uniform local support, and constitutional care, are especially required to prevent relapse.

Fig. 43.



[illegible]

5. *A* [illegible] *affection attacks the foot*; commencing about the toes, creeping upwards, and at length reaching the ankle. The part is studded with numerous small sores; and the skin and areolar tissue are at the same time hypertrophied. The skin is [illegible] giving an indolent character [illegible] A thin, fetid, unhealthy discharge oozes away; and sometimes burrows deeply; but there is [illegible] inter-communication of the sores. The nails drop off; and the [illegible]. The phalanges become [illegible]; and ultimately the me[illegible] The os calcis often suffers at

an early period. Pain is always considerable; and the system is weak and miserable. Sometimes the young are affected; more frequently those of middle life.

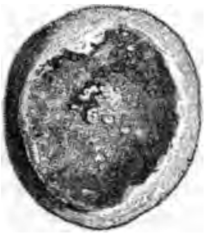
The disease is but little amenable to treatment. In the less advanced cases, rest, bandaging, and the more powerful alteratives, both local and constitutional, may effect cicatrization. But the part is prone to relapse. In many cases, amputation is ultimately required.

6. *The Vicarious Ulcer.*—Sometimes sores may be said to be of a vicarious nature. In females, for example, ulcers may form on the leg, or elsewhere, obviously connected with the menstrual secretion; becoming active, enlarging, and emitting a profuse discharge—sometimes sanguinolent—while the menstrual flux is, or should be, in progress; contracting, becoming dull, comparatively dry, and perhaps partially cicatrizing, during the intervals. Such sores, it is plain, can be attacked with safety and propriety only through the uterus. The functions of that organ must, in the first instance, be duly restored. Then, and not till then, need our attention be directed to the obtaining of cicatrization. With the uterine system in error, all local applications will be of but little avail; whereas, uterine health having been restored, the sore will often heal, and that rapidly, without any local treatment whatever.

7. *The Constitutional Ulcer.*—When a sore has existed for many years; almost stationary, or only varying with obvious changes in the system; tending to inflame and extend, during constitutional disorder; contracting again when this subsides; yet never approaching to complete cicatrization, without ill health ensuing; and this again relieved by re-establishment of the sore:—when the gouty diathesis is strongly marked, and its alternations are plainly connected with an ulcer's varying state:—when the patient is advanced in years, has been in hot climates, and may without injustice be termed a *bon-vivant*;—when an obvious relation exists between the sore and an affection of some internal organ, such as the kidney (p. 92):—under these circumstances, or such as these, we do not think of drying up the sore, which may be truly looked upon as a safety valve to the system; but content ourselves with the application of some simple and soothing dressing, such as wet lint and oiled silk. We leave what may be termed the ebbing and flowing of the ulcerative process entirely in the hands of Nature; our dressing tending simply towards comfort and protection.

The healing of such sores is never to be attempted. But there are others which, requiring great caution of interference, may yet ultimately be brought to heal; an issue having been made to supply their place, for some time at least, as a drain in the general economy. A sore, secreting constantly a considerable quantity of pus, may have existed for years in the limb of an elderly patient. No prudent surgeon would ever propose to dry up that suddenly, by rapid cicatrization—if he had it in his power so to do; without leaving some substitute in its room, at least temporarily. For, the sudden cessation of purulent discharge, to which the system had been long habituated, would be certain to occasion a plethora; this, in its turn, inducing determination of blood to certain parts. And thus serious danger to internal organs would accrue; by hemorrhage, sanguineous infiltration, or establishment of the inflammatory process. Apoplectic seizure is especially probable under such circumstances. Yet, doubtless, the continuance of such a sore is not only a considerable inconvenience, but likewise has a debilitating effect on the general system; and consequently tends to the induction of other disease, to whose accession constitutional debility is favorable. Its closure is therefore desirable. And should no unpropitious circumstances exist, as stated in the preceding paragraph, such closure may be safely enough conducted in the ordinary way; taking care, however, to establish an issue in some convenient and adjacent spot, so soon as the ulcer's discharge begins to lessen. This artificial drain is kept in full operation for some time—a fortnight or three weeks; and then, by gradually diminishing the bulk of the foreign body, by whose presence healing is prevented, and discharge maintained, the system is so gradually subjected to diminution of the waste, that its ultimate cessation is scarcely appreciated.

Fig. 44.



Cancerous ulcer, from the scalp.

8. Ulceration is a very frequent attendant on malignant disease; and is then termed *Malignant* or *Cancerous.* This will be considered in an after part of the volume.

In addition to the references under Inflammation, see Underwood on Ulcers of the Legs, Lond. 1783; Baynton's New Method of Treating Old Ulcers of the Legs, Bristol, 1799; Whately on the Cure of Wounds and Ulcers Without Rest, Lond. 1799; Sir Everard Home, Practical Observations on Ulcers of the Legs, Lond. 1801; Blackadder on Phagedæna Gangrenosa, Edin. 1818; Boggie on Hospital Gangrene, &c., Edin. 1828 and 1849; Higginbottom on the Nitrate of Silver, 1829; Stafford on the Deep and Excavated Ulcer, Lond. 1829; Duchatelet, Annales d'Hygiene Publique, tom. iv. p. 239, 1830; Skey on the Cure of Various Forms of Ulcers, Lond. 1837; Blandin, Dict. de Méd. et de Chir. Prat. art. Ulcere; Rust, Do Ulcerum Diagnosi, &c., Berol. 1831; Chapman on the Treatment of Ulcers, Lond. 1848 Critchett, Lectures in the Lancet, 1849.

CHAPTER VI.

MORTIFICATION.

Mortification is the general term which includes the whole process of death in a part, from its commencement to its completion. It is subdivided into *Gangrene* and *Sphacelus ;* the former denoting the process of dying; the latter, the result of this, or actual death of the part.

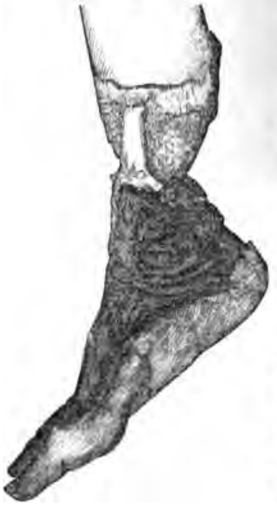
Gangrene being about to occur, as a result of inflammation, the signs of this affection become modified. The redness passes into a dark and livid hue; for circulation has ceased, and the blood is becoming decomposed. Circulation having been arrested, so is exudation; and the swelling grows less tense. On the surface, however, effusion of serum may take place; and that profusely. All vital function decaying, pain and heat remarkably abate, and often cease suddenly. Sensation gradually leaves the part. Just before, it could not be pressed on, however slightly, without aggravation of pain, previously severe; now, even rude handling is borne with impunity. Nutrition, the source of animal heat, having ceased, temperature necessarily decreases, and usually with rapidity. The part contains much inflammatory exudation, chiefly fluid; rapid putrescence increases both softening and moisture; and, as the result of chemical change, an offensive odor is more or less freely exhaled. The surface is usually studded with *phlyctenæ ;* that is, elevations of the scarf-skin by putrid serum; readily distinguished from the dark vesicles filled with bloody serum, which not unfrequently attend on simple bruise, by observing that the epidermis is detached from the cutis not only at the elevated spot, but all around; and that, consequently, the phlyctena may be made to slide from place to place, by slight pressure. Besides, the phlyctena is not attended with heat, pain, and swelling, as is the mere vesicle; but is associated with all the other symptoms of advancing gangrene. When this is limited to the part originally inflamed, the discoloration is circumscribed, and may have its border even abrupt; but when the disease, and injury which led to it, have both been severe—when the power of both part and system have been brought low—and when, in consequence, gangrene is to spread—discoloration is gradually lost in the surrounding skin, and dark streaks are seen shooting diffusedly upwards in the limb.

Sphacelus, or completion of the gangrene, is indicated by the part having become completely cold and insensible. It is shrunk in its dimensions, soft and flaccid, almost pulpy to the touch; and it crepitates distinctly, containing not only liquid but gaseous contents—the result of putrescence. All vital function has ceased, and chemical change reigns paramount. The color is usually dark when the part is exposed to atmospheric influence; but when removed from this, as in sloughing of the areolar tissue, or of fascia, and in necrosis—the integuments remaining yet entire—the dead portions retain their normal hue but little changed.

When a part dies to a limited extent—as a portion of skin, areolar tissue, artery, or tendon—the sphacelated part is termed a *Slough;* and the process of death, *Sloughing.*

Sphacelus being complete, and gangrene not extending, Nature instantly adopts means whereby she may free herself from a part which is of no further use, and [illegible] esence may prove seriously injurious. Its recovery [illegible] f it be allowed to remain in close contact with the livi[illegible] annot fail to absorb more or less of the noxious re[illegible] e, both gaseous and fluid; whereby a poisonous effect wi[illegible] ed on the system, already brought low by constitutional disorder attendant on the gangrene. The living part, in immediate contact with the dead, inflames; and, in consequence, the abrupt livid line is bordered by a diffuse, red, and painful swelling—*the line of demarcation.* This vesicates; the vesicle bursts; puriform matter is discharged; and an inflamed and ulcerating surface is disclosed—*the line of separation.* The furrow, so begun, gradually deepens; at first advancing with considerable rapidity, through the skin and areolar tissue, which are prone to ulcerate; but receiving a check, when fascia, tendon, or other fibrous texture is reached. The advance is seldom perpendicular, but in a sloping direction; and the inclination is usually towards, and, as it were, beneath the dead part; gangrene generally being most extensive superficially. In time, even the most resisting of the soft textures are got through by ulceration, nothing but bone remaining undivided. No hemorrhage occurs during this gradual division of the parts; for the inflammatory process has passed leisurely through its ordinary grades; exudation and organization of fibrin precede the suppuration and ulceration, protecting the otherwise loose tissues from purulent infiltration, and sealing up the otherwise open orifices of arteries and veins.

Fig. 45.



Complete sphacelus of foot and ankle. Detachment all but complete. The sloping line of separation well shown; studded with granulations.

Nature's amputation, so conducted, is unfortunately a reverse of the ordinary operation; producing a stump which is conical, and otherwise but ill-fashioned for useful purposes. The surgeon is, therefore, called upon to interfere in most cases; modifying the arrangement, and securing division of the bone at a higher point.

We have been hitherto supposing that gangrene has involved the whole thickness of a limb; the line of separation forming on the cardiac aspect of the sphacelus, and sloping downwards. When gangrene is less extensive, the process of separation is still the same; inflammation, suppuration, ulceration, on every aspect of the slough, until the dead portion is fairly separated from the living. On its separation, ulceration, still advancing, may be found beneath. But usually it is not so; the appearances are rather those of a healthy granulating sore. The inflammation is seldom greater than what is merely sufficient to secure disintegration and removal of that layer of living texture which is in contact with the dead part, for the purpose of separating and throwing off the latter; and, at every point where separation has been effected, inflammation and suppuration usually pass away; giving place to repair by granulation, which then slowly effects a closure of the breach. Inflammation, with ulceration, is the agent which makes the furrow; repair by granulation follows closely on its heel. And so it is in regard to dead bone; the line of separation is scarcely visible between the dead and living, when already preparations for the substitute bone have been begun.

Constitutional Symptoms of Mortification.

During the early period of inflammation, the constitutional symptoms are usually those of Inflammatory Fever; but so soon as gangrene has commenced, these symptoms pass more or less rapidly from the inflammatory type, to the *Typhoid* form of Constitutional Irritation (p. 40). The disorder has been so well described by Mr. Travers, in his late work on Inflammation, as to render a transference of the passage entire more than excusable. "The pulse is increased in frequency, and diminished in diameter and force; in many cases irregular, and in some intermitting. A peculiar anxiety of expression appears in the physiognomy, and a remarkable livor overspreads the face, the features of which, the nose and lips especially, are contracted and pinched. The anxiety is soon exchanged for a hebetude of expression, as if the patient were under the influence of alcohol or opium; involuntary movements and tremors affect the hands and fingers, and frequent sighings are observed, which are broken by occasional hiccup. The inclination for food fails totally, the surface of the tongue is coated with a brown fur, harsh and dry, leaving the edge and tip free, but without moisture. As the case advances, the entire tongue, fauces, and lips, become dry to incrustation, so as to require constant moistening; but with small quantities of fluid, for swallowing is slow, and attended with difficulty. The skin, which in the onset was dry, opens to a copious but clammy perspiration over the whole surface. It parts sensibly with its temperature, and feels cold as well as damp. The mind, at first irritable—then, after the total subsidence of pain, stupid—wavers, and becomes subject to illusions, chiefly of a passive and transient kind; expressed by half sentences, with a thick and broken articulation, and accompanied with startings and momentary gleams of insane excitement. In traumatic gangrene—the age and constitution being previously in full vigor—this low delirium is exchanged for fits of active and wild frenzy, accompanied with loud cries and vehement efforts, requiring a powerful and continual restraint; and this continues, with occasional intervals from exhaustion, for hours together; and subsides, often suddenly, in prolonged coma and apoplectic death." When but little of sthenic indication has preceded the gangrene, as in constitutions previously much weakened, or in the case of poisoned wounds inducing rapid death of the part, the delirium continues of the passive kind. The sphincters relax, and the excretions are passed involuntarily. The patient fumbles with and picks at the bedclothes. More and more marked are "the death-like coldness, the clammy sweat, the small, indistinct, and flickering pulse, and the cadaverous expression. In this state a patient will sometimes lie totally insensible, and unable to articulate or swallow for eighteen or twenty-four hours, and die without a groan or s.

Such is the character order which attends on gangrene. Death of a part o the frame, previously the seat of febrile disturbance, and ion is doubtless aggravated, by subsequent absorption of noxious matter from the moist and crepitating mass of putrescence. The symptoms are found to vary, as is to be expected, according to the previous condition of the patient, the extent of the gangrene, and the importance of the part in which it has occurred. When the vital powers have been previously low; when the mortified part is vast; when an internal organ has perished, even in a patch or speck only—the constitutional symptoms are invariably grave, and point to a fatal issue. The patient may sink within a few hours after commencement of the typhoid symptoms; he may linger on for days; or he may rally and recover.

As certain tissues are found endowed with a faculty of resisting ulceration (p. 130), so some are less prone than others to gangrene; such are those which are well supplied with vital power, and yet not especially liable to true inflammation—for example, the nervous and arterial tissues. In acute hospital gangrene, arteries are found beating in the dark and putrid mass; alive, while all is dead around them; but at length they also yield, and death is hurried on by hemorrhage.

Other tissues, again, are especially prone to mortify; as, for example, the skin and areolar tissue. And this obviously explains the sloping form which the line of separation generally assumes, when gangrene has invaded the entire thickness of a limb.

When mortification occurs in an internal part, many of the ordinary signs are of course absent; and yet the symptoms are plain enough. We have not before us the blackness, nor the coldness, nor the crepitation; but we have sudden cessation of pain, previously most severe; failure of the pulse, and prostration of the strength; clammy sweat, collapsing features, and hiccup. These having occurred, we may confidently look for the other constitutional symptoms of gangrene, above enumerated. In short, it is important for the practitioner to bear in mind, in the management of acute internal inflammations—as, for instance, in the case of strangulated hernia—that the combination of hiccup and marked prostration, with sudden cessation of pain, plainly tells him of gangrene having occurred in the part inflamed; and that he is to frame his prognosis accordingly.

The ordinary division of mortification is into *Acute* and *Chronic;* Acute comprehending the humid, inflammatory, and traumatic; Chronic —the dry and idiopathic. Generally speaking, the acute is humid, and the chronic dry: the fluids being retained in the one case, and parted with gradually in the other. But this is not invariably the case.

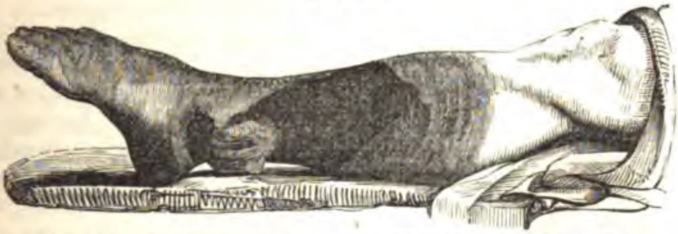
Cause of Mortification.

The cause of mortification may be broadly stated to be, whatever is hostile to vital power. But it will be convenient to examine this statement more in detail; considering separately those causes of local death, which most frequently come under the notice of the surgeon.

1. *Inflammation*, we have already seen to be a very frequent cause of mortification; by intensity of the process; by want of vital power—in part, system, or both—to control the process, otherwise not excessive; or by a conjunction of both circumstances. The gangrene may be said to be invariably humid; for not only is there no dissipation of the normal fluids of the part, but an absolute and decided increase of them by inflammatory exudation.

2. *Mechanical injury* may occasion local death, either directly or indirectly. The violence may have been so great, as at once to crush and disorganize the part; instantly depriving it of life. Or, less intense, it may have but lowered vitality by partial disruption of texture; at the same time acting as a palpable exciting cause of the inflammatory process therein, and so rendering the occurrence of gangrene by inflammation all but inevitable. Both forms are sufficiently common; and both, but especially the latter, are prone to spread rapidly, greatly endangering life by poisoning of the system. The mortification is acute and humid.

Fig. 46.

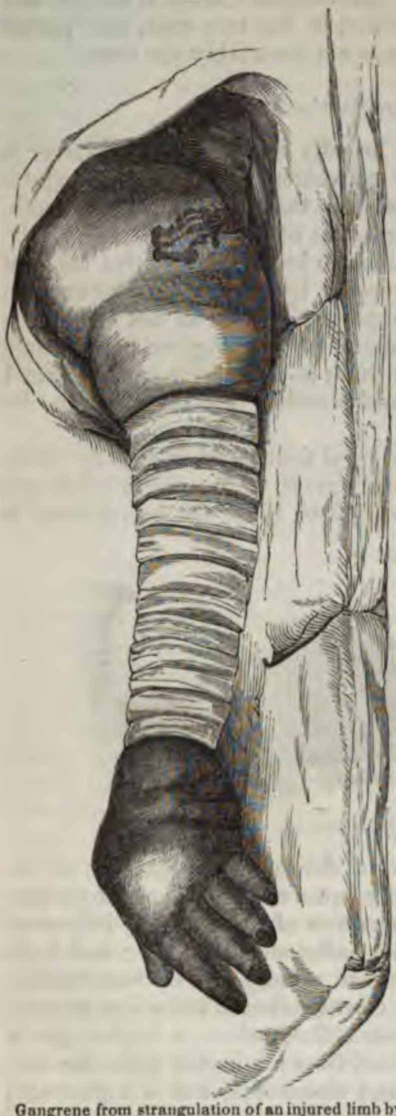


Gangrene after compound fracture; still spreading; no line of demarcation.

3. *Pressure*, gently applied, occasions absorption; a higher grade causes vascular excitement in a perverted form; a higher gives the true inflammatory products, suppuration and ulceration; and a higher still occasions death of the part. The last result may be either direct or indirect; that is, with or without the intervention of vascular change. Pressure being considerable and constant, with a low power in both part and system, death of the former may be immediate; as may often be observed, in the formation of bed-sores in the helpless and bed-ridden. Or, as was stated of mechanical injury in general, pressure may excite the inflammatory process and lessen vital power simultaneously; so rendering the part an easy prey to the former.

4. *Heat*, in like manner, may be so intense as at once to char the part; rendering it instantly dense, black, and brittle; as in the severest class of burns. Or it may only diminish power, and excite inflammation; as in the more common examples of this form of injury. *Acids*, and other chemical destructives, act in a similar way.

Fig. 47.



Gangrene from strangulation of an injured limb by absurd bandaging. JOHN BELL. Introduced on a large scale; *in terrorem*.

5. *Obstruction to Venous Return.*—The gangrenous effect of this is indirect. Passive congestion is induced; and so long as the obstacle to venous return continues, venous accumulation, with consequent effusion into the surrounding parenchyma, is inevitably increased. This abnormal state, necessarily weakening vital power, is also likely to excite the inflammatory process, as formerly shown (p. 172); and but a slight amount of this will suffice to overpower, in such circumstances. Thus, gangrene of the whole forearm has resulted from injudicious bandaging, or other deligation of the arm; no support having been afforded to the parts beneath. Retain the tight ligature used for venesection, and gangrene will be certain sooner or later to ensue; through the intervention of inflammation.

Or the obstruction may be by spontaneous change in the principal venous trunk; by coagulation of its contents, or by fibrinous exudation. Or it may be the result of compression by tumors of various kinds; or by organic change in internal organs—as the liver and heart.

6. *Deprivation of Nervous Agency* also acts indirectly. Bedsores, by sloughing, are well known to be most prone to form in cases of injury of the spine; the pressed parts being paralytic. Power is diminished, a tendency to inflammation is induced, and the application of a comparatively slight stimulus suffices to insure the gangrene.

Sometimes, no direct exciting cause is necessary. The cornea has sloughed after division of the fifth nerve; the same act at once arousing inflammation, and cutting off the nervous agency.

7. *Interruption to Arterial Supply.*—This may be complete; causing a direct cessation of life. A tourniquet placed and retained so tightly on a limb, as to arrest entirely its circulation, inevitably entails death of the whole limb beneath the encircled point; for, invariably, on complete arrest of circulation, the vital process ceases, and chemical change speedily begins. Besides, ordinarily arterial influx can be effectually arrested only by such means as must at the same time cut off all nervous influence; rendering retention of vitality, if possible, still more hopeless. Or the instrument may be applied with tightness sufficient to diminish, yet not so as to stop arterial influx. And then the result will be indirect, as in the case of obstruction to venous return only; inflammation being excited, while power is depressed. Or, after deligation of the principal artery of a limb, weakening vital power—inasmuch as collateral circulation can never be, at first, quite equal to the normal arterial supply—heat, friction, or other stimuli are applied; and gangrene occurs in consequence.

The first of these modes of death is comparatively a painless process; being immediate. Pain ensues only on the accession of inflammation, in the adjoining living parts, whereby the line of separation is formed. The second is painful; because tedious, and inflammatory throughout. And this it is important to remember. When we wish to get rid of a tumor, for example, or other noxious structure, not amenable to excision, we employ deligation. If we wish further, that the destructive process should be both speedy and easy to the patient—as doubtless, in the vast majority of cases, will be our object—we do not hesitate to put him to immediate pain, by tying the ligature with as tight a strain as it will bear; so as thoroughly to cut off its arterial supply, and altogether arrest its circulation. Whereas if, unwisely, we treat him now with a gentle hand, much unnecessary pain remains for the future. The part, being but partially strangulated, remains capable of assuming the inflammatory process; and the undergoing of that process, in the circumstances, is essential to the cure.

The most obvious illustration of this cause of gangrene is deligation; from without. But equally efficient obstruction to arterial supply may come from within; by rupture of the principal artery, or arteries; by consolidation of their canals, from fibrinous deposit of a plastic kind; by earthy degeneration of the vessels, as will afterwards be shown; or by rupture and diffusion of an aneurism.

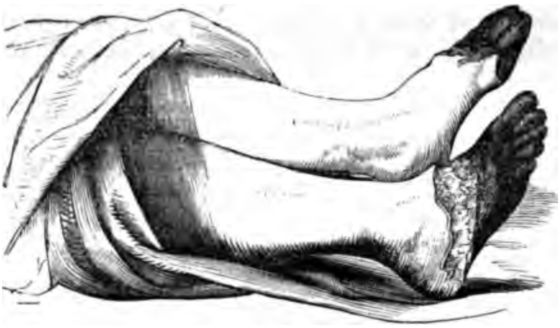
Perhaps the tendency to gangrene, in inflamed unyielding textures, may be caused, at least in some degree, by the tension which invariably ensues; this so compressing the part, as either to arrest, or seriously impede, the already weakened circulation.

In surgical operations, it is very useful to bear in mind that sudden and effectual obstruction, of both arterial influx and venous return is likely to prove fatal to the part. For instance, in performing deligation of the principal artery of a limb, on account of aneurism, we should be especially careful to avoid injury to the concomitant vein; for, if that be obstructed, as well as the artery, gangrene of the limb—even without the intervention of undue stimulus—is extremely probable. If we can imagine the principal nerve to be at the same time seriously injured, gangrene is all but inevitable; under the threefold evil influence, of arterial and venous obstruction, with deprivation of nervous agency.

8. *Cold.*—The effect may be direct or indirect; more frequently it is the latter. But direct it may be; thus. The immediate effect of cold, intense, and continuously applied to the part, is greatly to depress both its circulation and its nervous energy; and this depression, by continuance of the cause, may be carried so far as altogether to annihilate vital power. The part, in truth, is frozen to death; becoming cold, insensible, shrivelled, and discolored; by and by undergoing obvious chemical change, and becoming detached by the ordinary process of separation. This is likely to occur only in very cold climates; and even then, only when the individual is exposed to hardship and privation. The parts most liable to be so affected, are those most remote from the centre of circulation, and consequently by nature less fully endowed by vital power; and also those most habitually exposed to atmospheric inclemency—as the toes and feet, and the tips of the nose and ears.

Much more frequently the action is indirect. Cold is applied; and the lowering result follows, as usual, to a greater or less extent. The cold is suddenly removed; or, very likely, warmth with the additional stimulus of friction is applied. And the inevitable consequence is, immature and excessive reaction; the blood rushing back to the part it had but lately left, with far greater impetuosity than it had before; distending every vessel to the utmost; hurrying on the inflammatory process—and this is in a part not yet recovered from the depression of vital power, which the first effect of the cold had occasioned. The inflammation is sudden and intense; power of resistance and control is low; gangrene is inevitable. It is not the patient who is simply exposed to diminished temperature, that suffers from chilblain—chronic inflammatory process in a debilitated part; or from frost-bite—the inflammation, more acute, having reached sloughing. But it is the patient who, after exposure to cold, warms himself at the fire, or simply enters a heated room; or who, not contented with abstracting cold, and applying heat, adds friction to the affected part.

Fig. 48.



Chronic gangrene of the feet, after exposure to cold. Separation considerably advanced.

Illustrations of this are of constant occurrence; but there is one, on a large scale, which, though trite, is altogether so apposite and striking, that it may be well, by way of corroboration, briefly to notice it here. In his narrative, after the battle of Eylau, Baron Larrey says—"During three or four exceedingly cold days that preceded the battle, the mercury having fallen so low as fifteen degrees below zero of Reamur's thermometer, and until the second day after the battle, not a soldier complained of any symptom depending on freezing of the parts; notwithstanding they had passed three days, and a great portion of the nights of the 5th, 6th, 7th, 8th, and 9th of February, in most severe frost. The Imperial Guard, in particular, had remained upon watch in the snow, hardly moving at all for more than twenty-four hours; yet no soldier presented himself at the Ambulance. In the night of the 9th and 10th, the temperature suddenly rose; the mercury ascending to three, four, and five degrees above zero. From this moment, many soldiers of the Guard and line applied for assistance; complaining of acute pain in the feet, and of numbness, heaviness, and prickings in the extremities. The parts were severely swollen, and of an obscure red color. In some cases, a slight redness was perceptible about the roots of the toes, and on the back of the foot. In others, the toes were destitute of motion, sensibility, and warmth; being already black, and as it were dried. All the patients assured me that they had not experienced any painful sensation during the severe cold, to which they had been exposed on the night-watches. It was only when the temperature had (suddenly) risen, eighteen or twenty degrees, that they felt the first effects of the cold as inducing mortification." And it is added, that those who had warmed themselves at fires suffered most.[1]

But cold may in a similar way cause death, not of a part, but of the whole body. General vital power is depressed; sudden reaction ensues, by the imprudent use of stimulus; and, under this, the enfeebled system may succumb. In illustration, let us again quote from Larrey:—"Wo to the man benumbed with cold . . . . . . if he entered too suddenly into a warm room, or came too near to the fire of a bivouac. . . . . . Gangrene made its appearance at the very instant, and spread with such rapidity that its advances were perceptible by the eye. Or the individual was suddenly suffocated with a kind of turgescence, which appeared to affect the brain and lungs; he perished, as in asphyxia. Thus died the chief apothecary of the Guards. . . . . . He had scarcely been a few hours in this (warm) atmosphere, so new to him, when his limbs, in which he had lost all feeling, became considerably swelled; and he expired soon afterwards, incapable of uttering a single word."[2]

9. *Animal, and other Poisons*, applied to a part, by inoculation, or otherwise, are usually said to be powerful excitants of gangrenous inflammation. That is, they lower vital power, in both part and system; at the same time, exciting inflammation in the vicinity of the wound. Bites of serpents act in this way; as also inoculation of putrid virus, from cattle, or others of the lower animals, occasioning the "malignant pustule." And, much in the same way, there is no more certain cause

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[1] Larrey's Memoirs, tom. iii. p. 60.

[2] Op. Cit. tom. iv. p. 134.

of rapid and extensive gangrene, with most serious results to the system, than by the infiltration of urine into areolar tissue.

Hitherto, we have considered chiefly such causes as are local and external; we now come to those which are constitutional and internal.

10. *General debility*, from any cause—hemorrhage, starvation, age, persistent disease, or long continuance of any generally depressing agent—predisposes both to the accession of perverted vascular change, and to its untoward advance; there being but little power, either in part or system, for resistance or control. Or vital power may be so far diminished, especially in those parts naturally the weakest—being most removed from the centre of circulation—as to cause death in a more direct way, without the intervention of the inflammatory process; simply by mal-nutrition, and gradual failure of vitality in consequence. This latter mode is not unfrequently exemplified by simple gangrene of the toes after exhausting fever.

Fig. 49

Chronic gangrene; from general debility. Line of separation begun. Patient æt. seventy-five.

A peculiar disorder of the system, certainly not of the purely sthenic type, attends on the internal use of mercury, carried to sustained ptyalism. This seems very favorable to assumption of the inflammatory process; and to the invasion of sloughing, as well as of fierce ulceration, during its progress; a fact abundantly exemplified by the frequent occurrence of sloughing and phagedena, in an aggravated form, in venereal patients recklessly salivated.

11. *Improper food*, habitually taken, leads to disorder of the system of a feeble type; and thus will, at least, predispose to gangrene. But one poisonous article of diet, in particular, causes constitutional disorder of a very aggravated character; an almost invariable result of which is chronic and dry mortification of the extremities. The article alluded to is an unsound kind of rye; not uncommon in the north of Europe. A black, curved excrescence, not unlike the spur of a fowl, grows on the spike; and sometimes is found in such quantities, as to form nearly one-fourth of the produce of the rye. It is termed the Ergot of rye, or *Secale cornutum*. Its habitual use, as food, induces lassitude, weakness of the extremities, a feeling of intoxication, and periodic convulsive movements. This state, called *Raphania*, may continue for days or months. And frequently, during its persistence, mortification of the extremities occurs; beginning in the toes, and gradually extending up the leg; attended with but little pain, and without appreciable precursory inflammation; the part becoming at once cold, insensible, and discolored, and gradually dry, hard, and shrivelled. In some of the recorded

cases, the line of demarcation formed, separation was completed, and recovery took place. In the majority, however, the disease advanced, unchecked in either its constitutional or local form; and the issue was fatal. In this country, a somewhat similar malady has been traced to the use of unsound wheat.

12. *Atmospheric influence* acts favorably, or otherwise, on the system; more especially of the invalid. When a deleterious impression has resulted, no uncommon indication of this is the appearance of sloughing in a previously healthy wound or sore. To such a cause, for example, the invasion of hospital gangrene is perhaps most frequently attributable.

13. *Arterial degeneration.*—In advanced years, the whole arterial system, but more especially its ramifications in the lower extremities, are liable to degenerate; by deposit of calcareous matter between the coats, to a greater or less extent; sometimes converting them into completely rigid, and as if altogether ossified tubes. This, of itself, may exist so generally, and in so advanced a form, as ultimately to render efficient circulation through such altered conduits impracticable; and, circulation gradually ceasing, so does life. Death of the part ensues; a gradual and painless process. Or, ere the change has advanced so far as to cause complete arrest of circulation, but quite far enough sadly to enfeeble vital power, a low perverted process may be kindled; by some of the many exciting causes to which the part is liable. And feeble though such process be, it is usually sufficient to cause more or less extensive gangrene; for it invades a part whose power of resistance and control has been much impaired.

Again; it has been supposed by some, that the inflammatory process is liable to occur in the vessels themselves, when so changed; and as an invariable result of arteritis is known to be consolidation of the arterial contents, with consequent occlusion of the canal, and arrest of circulation—this, occurring generally in a limb, would be certain to induce its death. By Dupuytren it was imagined, that the greater number of cases were thus to be accounted for. But, without denying the possibility of the occurrence, or that it does sometimes so cause mortification in the aged, it seems more reasonable to believe that the painful and inflammatory form of this disease is attributable to the inflammatory process having invaded, not the arterial tissue alone, but the whole part.

Thus we find the old man peculiarly exposed to mortification, particularly in the parts naturally most weak—the feet and toes. To such mortification, usually gradual, chronic, and dry, the term *Gangræna senilis* is commonly applied. This disease, however, is not to be considered as invariably occurring in one way, and consequently in all cases amenable to one and the same mode of treatment; otherwise, much practical evil must result. Indeed, there is good reason to believe that, from this very circumstance, not a few lives have been hurriedly disposed of, which otherwise might have been long protracted.

Senile gangrene varies in its nature. 1. It is not necessarily attended by arterial degeneration. And when not so accompanied, but induced by simple general debility, incidental to advanced years, and perhaps aggravated by casualties to which every age is liable—it may occur with or without the intervention of inflammation. Circulation and vital power may gradually cease; or the latter is overborne by accession of the inflammatory process. 2. When calcareous degeneration does exist, there is a similar alternative of events; the death may be inflammatory or not; acutely painful, or comparatively painless.

In practice, perhaps the most important division of this form of mortification, is into that which is preceded and accompanied with the inflammatory process, and that which is not. For, to the variety of cause, ought the mode of treatment to be accommodated.

The accompanying inflammation is always of rather a low type; the part, of enfeebled power, being not only easily overcome by such, but being really incapable of [illegible] of high intensity. In consequence, the term *Infla*[illegible]ten applied.

Or the inflammatory a[illegible]ry forms may be blended. The latter may seize on o[illegible]onverting them, simply and quietly, into black and shrivelled [illegible] After a time, the mortification ceases to extend upwards. As usual, an effort is then made by Nature to throw off the dead and noxious parts; and this, we know, can be effected only in one way, by inflammation and ulceration. The process is accordingly assumed at the living margin; and heat, redness, swelling, pain, appear there. But the part has no sufficient power of control; the desired result of ulceration and suppuration is quickly overpassed; and mortification ensues. The inflammatory has become engrafted on the simple form; and proceeds rapidly, with much pain and constitutional disturbance. It would seem as if the attempt by vascular effort, towards arrest and separation, were being constantly made, and never with success; on the contrary, accelerating the destructive progress.

Thus, then, we may have senile gangrene throughout unattended with pain, redness, swelling, or other signs of the inflammatory process; excepting, ultimately, at the line of separation. Or, from the beginning, these are present; and continue until either arrest of the disease, or death of the patient ensue. Or the pain, heat, and redness, though at first absent, may supervene; and then continue of an aggravated character.

The disease is most liable to occur in males, of the higher ranks, who have indulged, freely and habitually, in the pleasures of the table,—all the more likely, if organic disease of the heart or aortic valves be present. And the most frequent form, is that which is attended by the *inflammatio debilis*. The original description of Mr. Pott merits quotation. He calls it "that particular kind of mortification, which, beginning at the extremity of one or more of the small toes, does, in more or less time, pass on to the foot and ankle, and sometimes to a part of the leg; and, in spite of all the aid of physic and surgery, most commonly destroys the patient." Usually "the patients feel great uneasiness through the whole foot and joint of the ankle, particularly in the night, even before these parts show any mark of distemper, or before there is any other than a small discolored spot on the end of one of the little toes. It generally makes its first appearance on the inside, or at the extremity of one of the smaller toes, by a small, black, or bluish spot;

from this spot the cuticle is always found to be detached, and the skin under it to be of a dark red color. Its progress, in different subjects, and under different circumstances, is different; in some it is slow and long in passing from toe to toe, and from thence to the foot and ankle; in others its progress is rapid, and horribly painful. It generally begins on the inside of each small toe, before it is visible either on its under or upper part; and when it makes its attack on the foot, the upper part of it first shows its distempered state, by tumefaction, change of color, and sometimes by vesication; but, wherever it is, one of the first marks of it is a separation or detachment of the cuticle."

The constitutional symptoms are such as characterize gangrene in general (p. 237); that is, constitutional irritation, tending towards typhoid collapse; but chronic in its nature, like the local affection. Pain, restlessness, and hiccup—especially the two former—are particularly prominent. The first may, in part at least, be accounted for, by the occurrence of inflammation in such dense and unyielding textures as the arteries often are. In the non-inflammatory form, constitutional disorder is often very slight; at least during commencement of the gangrene.

The *progress* of mortification is sometimes slow; making but little advance in days and even weeks—as in the senile, and other chronic forms. Sometimes it is fearfully rapid; as in the acute and traumatic; spreading, within a few hours, over a whole limb.

When arrest has occurred, Nature begins her process of *separation*; as formerly described (p. 236). A sthenic form of inflammation is established in the living margin; suppuration and ulceration supervene; and this destructive process is in its turn followed by granulation, and effort towards repair. At the same time, the symptoms of constitutional irritation gradually subside; and a sthenic and normal state of system is restored.

Prognosis varies, according to the extent of the mortification, the nature of the part in which it has occurred, and the condition of the system during and before its accession. The larger the gangrened part, the greater its importance as a portion of the general economy, and the lower the constitutional powers, the greater is the danger to life.

Treatment of Mortification.

The treatment of mortification, in general, resolves itself into five principal indications. Remove, or mitigate the cause; wait for the line of demarcation; assist Nature, in her efforts towards detachment; promote and regulate the healing process; and maintain due power of system, throughout invasion, arrest, and cure.

But, in the first place, let diagnosis be accurate; be sure that it is a case of gangrene. In mere bruise, there is discoloration of a livid hue; and dark-colored serous vesicles form, somewhat resembling phlyctenæ. But the points of difference, formerly noticed, are sufficiently plain (p. 235). And it is well that such is the case; inasmuch as error of diagnosis would infallibly lead to serious error of practice. On undoing a fractured limb, for example, after the first application of retentive apparatus, it is not uncommon to find it swollen, darkly discolored, and studded by dark vesications. If this be gangrene; amputation, at some distance above the parts so affected, cannot be too soon performed. If it be but the effects of bruise; fomentation, mild antiphlogistics, and gentle reapplication of retentive means, are all that the circumstances demand.

In the inflammatory form, removal of the cause is to be attempted, by antiphlogistics. And, prevention being better than cure, it will of course be advisable to have recourse to these early and efficiently; so as to arrest the inflammation's progress timeously, and save the vitality of the part. But let not the chance of immunity from gangrene be purchased at too high a (ral bloodletting, with other spoliative and depressin ake much impression on the inflammatory process; a the occurrence of gangrene, at the time. But the pr the dead parts, followed by attempts at repair, has to co exhausting discharge; the powers of the system are certain to be severely tried; and if they have been, at the outset, imprudently exhausted, they cannot fail to sink when they are most required. Besides, bleeding may not secure even the temporary benefit; on the contrary, general and local power may be so weakened thereby, as to render them an easy prey to inflammation even in a subdued form.

Often antiphlogistics are thus used, with a blind and rash improvidence. The cure is protracted and embarrassed; the system is enfeebled, and perhaps for ever broken; or even the issue may be fatal. Cases of threatened gangrene, after severe bruise, laceration, fracture, &c., afford abundant illustration of this practical point. The ulterior result must always be regarded, along with the present; and both provided for. We are to prevent or limit gangrene if we can: yet using antiphlogistics so as to make sure of leaving power enough of system, for defence from hectic and exhaustion during the suppurative stage.

Also let it be borne in mind, that it is only before, and at the very commencement of gangrene, that antiphlogistics can ever be actively employed. When mortification has been fairly established, the symptoms change, and require a corresponding alteration of treatment; inflammatory fever, sthenic, is superseded by asthenic constitutional irritation. And further, when gangrene is both certain to occur, and to prove extensive, the symptoms corresponding to that result are often foreshadowed in the characters of the preceding inflammation, both locally and generally; modifying these in so marked a manner, as at once to enlighten the experienced practitioner regarding the impending issue. Such a state, not unfrequently connected with a previously debilitated power of system, is often, and not inappropriately, termed *Gangrenous inflammation*; and in this, antiphlogistics, at however early a period employed, must invariably be used with the greatest caution and forbearance. On the other hand, if inflammation be intense, limited, seated in an important part, with both local and general symptoms plainly sthenic in character, and occurring in a robust unbroken frame—we may bleed copiously and fearlessly; employing also the other suitable antiphlogistics with energy. For, in these circumstances, such are the only true preventives of gangrene.

Constitutional remedies, foolishly held as specifics, and termed *Antiseptics*, were at one time much in vogue; and may not yet have fallen altogether into desuetude. Of these, the most prominent was bark; given in full doses. The exhibition of this, at an early period, will plainly aggravate the disorder; offending the stomach, increasing the fever, influencing the inflammation unfavorably, and rendering the gangrene both more speedy and more extensive than it otherwise might have been. It can only be of use, as other tonics, after the period of excitement has gone by; limiting or preventing hectic, and assisting the system to bear up under the exhausting influence of suppuration.

Previous to gangrene by inflammation, then, antiphlogistics are expedient; early, active, yet cautious; invariably controlled by regard to the impending future; their object being to prevent local death if possible, and yet not seriously to impair general power. When gangrene has occurred, they may be continued, in sthenic cases; but now with still more subdued caution; to limit mortification as much as possible, but still without injury to the system. When, however, the constitutional symptoms of gangrene are fully developed, of their usual type, antiphlogistics are wholly unsuitable. The disorder has passed from inflammatory fever into a grave form of constitutional irritation, tending to collapse; and calmatives, support, tonics, stimuli, will probably be required. Opium, in full doses, and frequently repeated, is an admirable remedy at this stage; calming the general system, blunting the sensation of pain and illness, and seeming to impart a power of tolerance to the frame under the depressing agency of the local change. At the same time, more or less stimulus is usually indicated; and the preferable forms are the alcoholic, and ammonia; administered with the cautions formerly explained (p. 80).

Hiccup, it will be remembered, was spoken of as particularly troublesome, in many cases. If it do not yield to general treatment, musk, camphor, ammonia, naphtha, may be employed as special correctives.

When gangrene has ceased, and separation been commenced, usually the general symptoms again change towards the sthenic form; and, in consequence, a guarded and somewhat antiphlogistic regimen will probably be expedient; lest the process necessary for detachment should prove excessive, and reinduce sloughing. But, on the contrary, should both general and local appearances betoken debility, cautious support by nourishing food, and the more simple tonics, must be maintained. When detachment has been completed, we have then to do with a simple sore—inflamed, ulcerating, granulating; weak, irritable, or healthy, as the case may be. And the ordinary treatment is to be conducted accordingly.

If a palpable exciting cause appear—as deligation, obstructing venous or arterial circulation, or both—that, of course, must be instantly removed. Infiltration of poisonous or acrid fluid will be got rid of, or limited in its effects, by free incision. Noxious atmospheric influence must be either changed, or neutralized as far as possible. If sloughing be from compression, the pressure must be removed or modified; if from bad food, diet must be amended; if from mere general debility, that must be obviated by a suitable support.

Mortification by *Pressure* very frequently engages the attention of the practitioner; a common result of long confinement to the recumbent posture, especially in the weak and paralytic; sometimes occasioned by inaccurate or injudicious adjustment of retentive apparatus, in the treatment of fracture. When sloughing, by such causes, has been induced, it proves a source of much inconvenience to both patient and surgeon; as can be readily understood. It is to be avoided, by care in subdividing the pressure among many points; preventing its concentration, and maintenance, on one or two alone. In fracture of the leg, for example, retentive means will be a [illegible] s not solely the malleoli, or the heel, but to be equal [illegible] le surface of the bandaged limb; and such precauti [illegible] desirable, in the case of the aged and weak. When [illegible] tened, the points naturally most compressed—over the sacru [illegible] ers, heels, scapulæ, elbows—must be relieved as much as possible: by frequent variation of posture; by the adjustment of pads, or pillows, on the adjacent parts; and, if need be, by the use of these admirable contrivances for such purposes, the hydrostatic bed, and the spring-bed, by which the labor of support is equally distributed on every part of the surface. Of the two, the spring-bed[1] is perhaps the more generally suitable; being equally useful, in the way of uniform support; and being free from the disadvantage of dampness, requiring frequent change of the clothes and mattress.

The reddened and painful parts (for it is usually by inflammation the part perishes; power being seldom so very small, or pressure so very great, as to occasion immediate and direct death) are to be pencilled over with nitrate of silver, either in substance or in solution, so as merely to blacken the integument; carefully avoiding the vesicating effect, our object being simply to resolve the inflammatory process. Or a solution of corrosive sublimate may be used; which has the effect of hardening the part, and rendering it less susceptible of the influence of pressure. At the same time, of course, our utmost efforts will be directed towards the general recovery of the patient; in order that recumbency may become unnecessary. When breach of surface has ensued, it early assumes the weak character; requiring stimulating applications, accordingly.

When *mechanical or chemical injury* is the cause, we have seldom the power of altogether preventing mortification; limitation is our object. So soon as the first shock has passed over, our treatment is antiphlogistic; in order that death may be confined to the parts which suffer directly from the injury. We seek to save those which have their vital power less diminished, and which might contrive to live, if let alone; but which would be unable to combat brisk inflammation successfully. A certain amount of inflammation must ensue; but we are anxious to limit it to what is merely necessary to effect detachment of the original slough. During the progress of detachment, the antiphlogistic regimen will probably be expedient. Thereafter, by improved diet, and other tonic means if necessary, the general power is to be maintained;

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[1] Lancet, No. 1372, p. 633.

sufficient to ward off hectic, and duly carry forward the operation of repair.

In the case of mortification from *Cold*, it is our duty to prevent the occurrence if possible. And, as in this climate, it is seldom that the destructive result is by the direct effect, but by the secondary or reactive, such prevention is not unfrequently within our power. Plainly, it is to be accomplished by moderating reaction; abstracting cold, and yet not applying sudden heat or other stimuli. The common practice is very successful; and, though perhaps not actually based on scientific principles, can be most satisfactorily explained by them. A part undergoing the freezing process—threatening to die by the direct effect of intense cold—becoming pale, shrunk, and but little sensible, is rubbed with snow; while the patient and part are yet in the open air, or at least not exposed to sudden elevation of temperature. Rubbing arrests the sedative effect, and induces reaction; and rubbing with cold insures the reaction being gradual, slow, and safe. Circulation and nervous influence are restored; and returning vital power, finding no undue excitement to oppose or control, reigns paramount.

When gangrene has set in, by reaction proving excessive, our object is to moderate this; and at the same time to sustain constitutional power. Locally, employing poultice, water-dressing, pencilling with nitrate of silver, or other soothing applications; with careful regulation of diet, and administration of suitable remedies internally—at first moderately antiphlogistic, then opposed to constitutional irritation. On separation of the sloughs, the customary treatment is adopted.

In the chronic gangrene of old people, the *Gangræna senilis*, we may have two distinct forms, as already shown; death, direct, from mere want of power; or death indirect, weakened power being overcome by inflammation. In the former case, cautious general support is expedient; enough to maintain and increase general power, yet cautious, to avoid the induction of an inflammatory process, which we know the part is unable to bear. The part itself may be covered over with tepid water-dressing, or with any other bland protective application.

In the second, or inflammatory form—much the more frequent—our object should be to subdue the local inflammation; yet without impairing, and on the contrary rather adding to, the general power of system. The best local application with this view, is the nitrate of silver; pencilled over the red, painful, and swollen parts, so as merely to blacken, and obtain the simply sedative and antiphlogistic result (p. 158); covering the part, afterwards, with a light poultice, or water-dressing. The patient should be kept in the recumbent posture, with the part somewhat elevated. The diet must be non-stimulant; otherwise inflammation, already beyond the power of the part to bear, will be further increased. At the same time, it must not be truly antiphlogistic or starving; otherwise, both general and local power, already weak, will be still further impaired; and the existing inflammation, even without increase, will be rendered more and more destructive. It will consist, then, of simple farinaceous food; such as will maintain power, and yet not favor undue vascular excitement. Also, the continued use of opiates is highly expedient. Great pain and general irritation attend the progress of the disease. The former is in part alleviated by the nitrate of silver. Both will be much assuaged by opium; which further, according to some, would seem to exert a beneficial tonic effect on the capillaries; thereby tending to increase vital power, in circumstances where it is much required. Under such treatment, we expect, and often not in vain, that pain, redness, and swelling, shall cease; as also the advance of mortification. A healthy line of demarcation is established; the dead parts are thrown off; the patient rallies greatly in his system; and, in short, recovery is obtained, though not of course without more or less mutilation.

But such was not the practice, and such were not the results, of former times. The practitioner took but a one-sided view of the case; observing deficient power alone, and overlooking redundant excitement. His patient was literally crammed with diet of the most rich and stimulant kind. If in the better ranks of life, his table was made to groan daily, under the most sumptuous viands; and yet the generous food seemed only to feed the disease, not the patient. The dusky redness spread more and more; and both part and frame sank under it. The error was at length perceived, and an opposite extreme was gone into. Seeing then nothing but inflammation, antiphlogistics were employed; as if the process were of the ordinary sthenic form; disregarding the want of power, which did not fail to increase under the neglect. Dupuytren, for example, trusted to venesection. Now, a middle place is wisely selected. We neither stimulate nor spoliate the system; local disease is moderated, while both local and general power is enhanced and maintained; and the result is altogether satisfactory.[1]

Local Applications in Mortification.

Local as well as general antiseptics were at one time believed in: of an alcoholic, terebinthinate, or otherwise stimulating nature. If employed previously to the accession of gangrene, while inflammation is still in progress, they invariably prove injurious; by hurrying on that process, already excessive. During progress of gangrene towards sphacelus, all stimulation of the part must still be prejudicial; for a like reason. When sphacelus is complete, the stimulants, acting on the surrounding living parts, which are being sthenically inflamed for the purpose of effecting detachment, are likely to aggravate such excitement to an injurious extent. As to their effect on the dead parts themselves, it is either nugatory, or the reverse of beneficial. For, however useful spirits of wine or turpentine may be, in preserving parts already detached from the system, similar preservation is certainly not what we desiderate during the process of separation. On the contrary, sloughs cannot be too soon removed from the living tissues. Local stimulants, therefore, improperly named antiseptics, are not only useless, but hurtful.

Scarifications were also at one time in vogue; usually with the view of enabling the antiseptics to prove more effectual. If they merely implicated the dead parts, they were inefficient. If they penetrated these, and reached the living and inflaming stratum beneath, they obviously did harm; as undue stimulants. Under only two circumstances, are incisions likely to prove beneficial in gangrene. First; when suppuration has freely occurred beneath a separating eschar; which, being marginally adherent, and itself incapable of the ulcerative process, induces all the evils of tension and pressure on an acutely enlarging abscess. Incision through the eschar, under such circumstances, will afford infinite relief; and it is not unfrequently thus required, in cases of burn. Second; when by free incision we may remove the cause of gangrenous disaster, past, present, and impending; as in phlegmonous erysipelas, and in diffuse areolar infiltration whether of a purulent or urinous kind.

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[1] Lancet, No. 602, p. 850; see also Mr. Syme's notice of this affection, London Monthly Journal of Med. Sc., 1st January, 1841, where, however, the restriction of regimen is stated rather too strongly; Lancet, No. 1138, p. 720; also Association Journal, April 22, 1853, p. 346.

During the formation and separation of sloughs, light poultice, or warm water-dressing, are the preferable applications; soothing, grateful, and protective to the living parts. Often, the latter may be advantageously medicated, by solutions of the chlorides of lime and soda; at first chiefly applied to the dead parts, as correctives of fetor; afterwards used not only with this view, but as a suitably stimulant lotion for maintaining reparative energy in the living ulcer.

As sloughs become detached, by the undermining process of ulceration in the living stratum, they should be taken away; such cleansing of the part tending to diminish fetor, as well as the risk from absorption of the results of putrescence. If necessary, scissors are employed; cutting with these only in the dead part, however. For, in affording assistance to Nature in her detaching efforts, we should occasion neither one moment's pain, nor the loss of a single drop of blood. Pulling rudely at yet adherent sloughs, or cutting in living parts, is not unlikely to reinduce sloughing; more especially when gangrene is of the chronic form, and attended with general debility. After separation, both part and system are treated as in ordinary granulation; only with a foreknowledge that, on account of previous exhaustion, support will be soon demanded on the part of both.

The nitrate of silver we have seen to be very useful, as an opponent of the *inflammatio debilis*, in chronic gangrene. By some, it has been employed with another object in view, during advancing gangrene; applied intensely, to the sound part, so as to produce vesication, inflammation, and ulceration; instituting, as it were, a fictitious line of demarcation; and attempting to dictate to Nature the point of arrest. It need scarcely be said, that the result has disappointed the expectation. Nature is not thus to be schooled. Inflammation was doubtless excited; not of the sthenic type, which alone can give the ulcerative sulcus of separation; but still of the asthenic and excessive kind, courting and hastening progress of the mortification.

Question of Amputation.

1. Amputation is not unfrequently advisable, in order to *prevent* the occurrence of gangrene. Thus; when a limb has been much injured by mechanical or chemical means—in the case of a severe compound frac-

ture, or burn, for example—and it is apparent to the experienced observer that mortification must ensue, involving the whole thickness of the limb, acute, tending to spread, and from the first accompanied by the most formidable constitutional symptoms—amputation is performed above the injured point; so soon as the primary shock has passed away, and the system rallied so far as to afford sufficient tolerance of the operation.

2. When, after such injuries, gangrene has set in, of the acute and spreading kind, there is now no question as to the propriety of immediate operation. At one time, it was by many considered right, in this and in all other cases of mortification, to wait for the spontaneous line of separation. But delay, under these circumstances, with such an object in view, will be in vain. The gangrene spreads upwards and upwards, with a diffused and streaky margin; the typhoid symptoms grow more and more intense; the trunk is reached, rendering operative interference hopeless; or, long ere this, the system has sunk, and the patient perished. The only hope of escape is by early amputation. It is a slender chance (for the probability is that sinking may continue, or even gangrene may be resumed); but it is the only one; and to it the patient is entitled. While the mortification is spreading, we amputate at a distance from the gangrened part; in one which is sound, or at least appears to be so. If there be no point distal to the trunk, altogether free from the signs of incipient death, we refrain from the knife; its use must then prove futile, and would but accelerate the fatal issue. And, in selecting the line of incision, when amputation is advisable, it is well to remember that the subcutaneous areolar tissue is often an earlier victim to gangrene than the skin itself; that, therefore, the immediate vicinity of the discolored margin is never suitable; and that, in all cases, careful manipulation should be employed, to ascertain, if possible, that all textures, as well as the skin, are yet sound; otherwise, we might be cutting in parts not only doomed, but dead. Sometimes a case presents itself of acute traumatic gangrene, in which there is even much space apparently suitable for amputation; but in which the constitutional depression has advanced so far, as to render the shock of an operation, then performed, certainly fatal. In such circumstances, our attention must be mainly directed to rousing the vital powers; sustaining them under the depressing agency; and if, thus aided, they fail in attaining to even a temporary ascendency, we refrain from operation.

3. In the chronic form of gangrene, arising without apparent external cause, there is no such haste in the use of the knife. Nature's initiative is calmly awaited. For, until the line of separation has been formed, we cannot know how far the gangrenous conspiracy between inflammation and vital power has extended. If we amputate during progress, it is most likely that we shall be cutting in parts foredoomed. They had not power enough to resist the *inflammatio debilis*, which was gradually creeping on; and certainly will not, for an instant, withstand the graver amount of inflammation, which such formidable incisions must inevitably excite. And, further; even after the line of separation has occurred, and is duly advancing, it is probable that, local as well as general debility being still great, the parts have just power enough to sustain the

spontaneous inflammation necessary for the ulcerative process, and would undoubtedly perish under the greater amount induced by the stimulus of incision. Therefore we wait, not only until the line of demarcation has been made, and separation begun; but until the latter has been in a great measure completed; assisting Nature's amputation, rather than operating ourselves; using our knife and saw merely to divide the fibrous and osseous textures, which are slow to ulcerate in this way; injuring the living parts as little as possible; yet sloping the knife upwards, in order to have an opportunity of sawing the bone so high, as to afford a fair prospect of the stump proving sufficiently fleshy and useful (Fig. 45).

In such cases, the system is very intolerant of loss of blood; and that is another reason why incisions should be so guarded. There is a circumstance, however, attendant on the disease, very favorable in this point of view. The dry, hard, impenetrable sphacelus has the same effect on the arterial tubes, on its cardiac aspect, as a ligature. *Remora* of their circulation is induced; coagulation takes place; and each arterial canal is obstructed, up to the nearest open collateral branch. As the line of separation passes through, the canals are further and more securely shut up, by fibrinous deposit; such ulceration being of the sthenic kind, and, as usual, preceded and accompanied by plastic exudation. Even supposing, therefore, that our knife does encroach a little on the living parts, higher than the line of spontaneous ulceration, hemorrhage is likely to prove but trifling.

4. In the chronic gangrene which is induced by cold—an obvious external cause, and independent of constitutional vice or failing—we still await the line of demarcation; for, otherwise, we cannot tell how far the fatal amount of local depression has extended. But after separation has been fairly and spontaneously begun, we do not hesitate to amputate; and with the option of either finishing Nature's operation just commenced, or of cutting in a higher and perhaps more suitable situation. For, the debility being only local, temporary, and not dependent on organic change, occurrence of the line of separation is sufficient evidence that in every point of the living parts there is then tolerance of operation. Usually, a better stump can be fashioned at a higher point than that which Nature has happened to select. But were such amputation to be made previous to arrest of the gangrene, most probably the flaps would speedily slough.

Thus then, when gangrene is acute and humid, dependent on an external cause, and unconnected with a previously existing failure of system, or organic change in the general limb, we amputate, if at all, during progress of the disease; without waiting for a line of demarcation. When it is chronic and dry, dependent on an internal cause only, or on internal more than on external causes, and connected with failure of both general and local power, we wait for the line of demarcation, watch the progress of separation—cautiously supporting the system meanwhile—and when detachment is far advanced, we interfere merely to facilitate and modify its completion; we amputate in the line of separation. When gangrene is the result of one particular external cause, cold, we await the line of demarcation; and, so soon as that has been fairly formed, we amputate either there, or above, according as circumstances may seem to require.[1]

In addition to the References under Inflammation, see O'Halloran on Gangrene and Sphacelus, Dublin, 1765; Pott's Surgical Works, vol. iii, p. 185, Lond. 1808; Larrey, Mémoires de Chirurg. Militaire, tom. iii, p. 60, and p. 141, 1812; Delpech, Mémoire sur la complication des plaies et des ulceres, connue sous le nom de pourriture d'hôpital, Paris, 1815; Hennen's Military Surgery, p. 241, Lond. 1820; Guthrie on Gunshot Wounds, p. 111, Lond. 1820; Lawrence, Med. Chirurg. Trans. vol. vi, p. 184; Turner on spontaneous obliteration of the larger Arteries, Edin. Med. Chir. Trans. vol. iii, 1828; Porter, Dublin Jour. of Med. Science, vol. iv, 1833; Dupuytren, Leçons Orales de Clinique Chirurg. tom. iv, art. xi, Paris, 1834; Cruveilhier, Anat. Pathol. livr. xxvii, and Dict. de Médecine et de Chir. Prat. vol. iii, p. 394; Liston, Lancet, No. 602, p. 850, 1835; Brodie, Lectures, Med. Gazette, 1840–41; Syme, Monthly Journal, Jan. 1841; Balling, ueber die Gangræna senilis, Journal von v. Graefe und v. Walther, vol. xiv, p. 42. In connection with Gangrene caused by ergot of rye, see Langius, Descriptio morborum ex usu Clavorum Secalinorum, 1707; Duhamel, Mémoires de l'Acad. de Sciences, p. 528, Paris, 1748; Woolaston, in Philos. Transact. p. 523, Lond. 1762; Prescott on the effects of Secale Cornutum, Lond. 1813; Rust's Magazine, xxv; Pereira, Elements of Materia Medica, part ii, Lond. 1840.

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[1] To these rules there are occasional exceptions. Sometimes, in a spreading acute gangrene, for example, it may be prudent to await the line of demarcation. And sometimes, in chronic gangrene, it may be expedient to amputate independently of this. Such exceptions are only occasional, however; and, as usual, do not fail to strengthen the general rules.

CHAPTER VII.

HYPERTROPHY, ATROPHY, AND ABSORPTION.

THE nutrition and growth of the structures of the body are liable to become deranged, apart from all trace of the inflammatory process. In the normal condition, a certain proportion is maintained between the supply of nutritive material by the bloodvessels, and the waste of tissue or absorption of the effete matter. Absorption is effected partly by veins, as well as by lymphatic vessels specially adapted for the function. This, occurring in excessive or diminished proportion as regards the antagonistic function of nutrition, produces various effects on the part involved in such departure from health. And it is plain that the abnormal state may depend on derangement of either process.

When the capillaries of a part deposit an amount of plasma simply sufficient to supply what is dissipated by the current expenditure, the result is normal; the condition is that of health. When more is exuded than is required to atone for waste, there is necessarily accumulation of the excess; the condition is a morbid one, and termed Hypertrophy. When, on the contrary, deposit from the capillaries is insufficient, by deficiency of arterial supply; or when absorption exercises its function to excess, the condition of deposit remaining unaltered from the state of health—the result is of an opposite kind—still morbid—and called Atrophy.

Hypertrophy.

Hypertrophy, or increased volume of a part, may be the consequence of increased supply or of diminished waste. In the former case, when the process is rapid and accompanied with a distinct exudation, it is usually of inflammatory character. But when slow and imperceptible in its accession, and marked by mere excess in the quantity of normal elements, it is called Simple Hypertrophy. In some cases, this name is applied to a collateral increase of several of the tissues composing a part or organ; in other instances one structural element may be enlarged at the expense of the rest, or while these remain stationary; so that in the application of this, as of the corresponding term Atrophy, there is considerable latitude.

The most marked instances of hypertrophy occur from perverted nutrition, which has often a low or chronic inflammatory type. Such are the indolent tumors of glands, the thickening and induration of areolar texture, the enlargement of bones under chronic processes of disease. Hypertrophy also occurs from exalted functional activity; as in the highly-wrought muscles of the blacksmith's arm, or in one kidney when the opposite has been lost by structural change. Again, hypertrophy, chiefly of the fatty tissue, may take place from over-assimilation with deficient exercise; the effects of this cause upon the organs of motion, however, being of quite an opposite kind. And other perversions of nutrition, of the most varied character, lead to hypertrophy of particular organs.

The treatment of hypertrophy will vary according to its cause. When this is inflammatory, the usual antiphlogistic measures will be pursued. Scrofulous or other enl [illegible] ls will be treated by iodine externally, with the use [illegible] d careful regimen. Hypertrophy from undue exe [illegible] t always distinctly morbid; when it is so, the remov [illegible] the only effective mode of treatment.

Atrophy.

Atrophy of a part, we have just seen, may occur in two ways; from excess of waste, or from deficiency of supply. In most cases, it is probable that both circumstances concur to establish the result, although the major part is attributable to the latter. The part is gradually diminished in bulk, its structure usually becomes somewhat modified, and its function is more or less deranged.

This state may follow on the inflammatory process; as a remote consequence, not as a direct result. The connection is usually with the chronic form. That affection ceasing, absorption busies itself to remove the loaded change of structure; and this exaltation of function may be continued beyond what was necessary to restore the healthful balance. Besides, that disuse of the part which attends on chronic inflammatory disease will necessarily have the effect of diminishing the arterial circulation; and this latter cause of wasting may be further contributed to, by a remaining change of structure in the part itself. Or any of these causes may of themselves be equal to the result. Thus a testicle, which has been simply inflamed, may become simply atrophied; a limb which has been long disused, on account of inflammatory disease of a joint, or from any other cause, invariably is more or less wasted; granular disease of the kidney is accompanied or followed by decrease in the bulk of that organ.

Treatment.—The indications are simple. To allay the process of absorption; to strengthen the function of the bloodvessels, more especially of the arterial system. The former may be sought by gentle counter-irritation—as slight blistering, or inunction of croton oil. The latter, probably the more important of the two, is fulfilled by use of the part, friction, and electro-magnetism if necessary; with resumed function, the nutritious effort is aroused, and normal development usually restored.

Atrophy may not be limited to a part, but may affect the whole system; the result of imperfect nutrition—in many ways induced. But this general morbid state does not come within the peculiar province of the surgeon.

Absorption.

Absorption may be regarded as a partial atrophy, leading to more or less deformity of the organ in which it occurs; differing however from ulceration in the absence of discharge, the waste matter being received back directly into the blood. Absorption may take place at an indefinite number of points in a tissue, or it may spread regularly as from a centre; in the former case it is *interstitial*, in the latter *continuous*.

Interstitial Absorption is most frequently observed in the hard tissues; usually resulting from a low form of the inflammatory process, and dependent, chiefly if not wholly, on an exalted and perverted exercise of the absorbent function. The process is most distinct in bone; converting what was dense into cancellated texture; or, being limited to certain points, interspaces of normal tissue remain, the whole having a worm-eaten appearance (Fig. 50). The superimposed soft textures are usually in a state of passive congestion. The part is slightly swollen, puffy, and darkly discolored; there is a deeply seated dull gnawing ache, rather than pain, aggravated by firm pressure. Weakness is complained of in the part; and marked increase of the unpleasant sensations follows

Fig. 50.

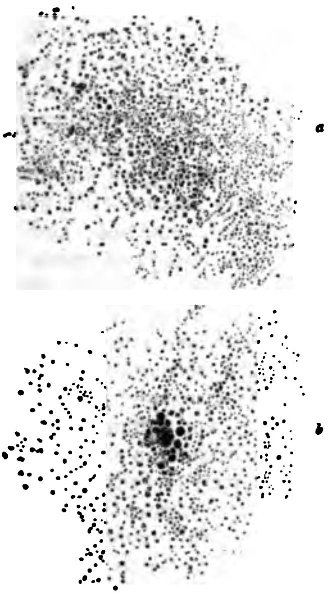


Fig. 51.

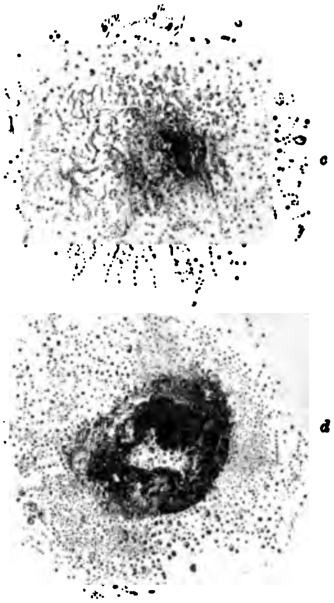


Fig. 50. Interstitial absorption in progress, in the cranium; at *a*, just begun; at *b*, more advanced. It may stop here; producing a merely cancellous state of the tissue; or it may advance, becoming merged in ulceration, and producing caries, as in Fig. 51.

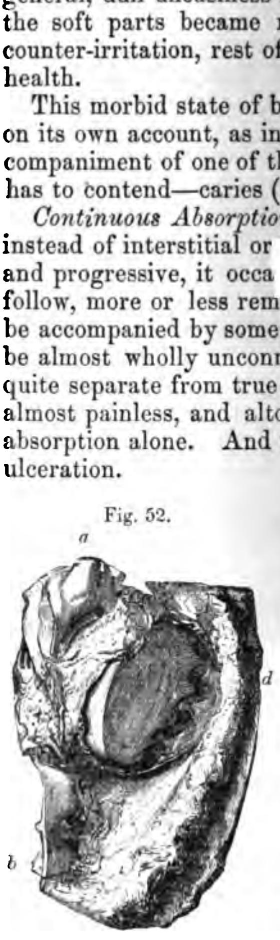
Fig. 51. Different portions of the same skull as Fig. 50; at *c*, ulceration established, surrounded by interstitial absorption; at *d*, caries, with necrosis, in the centre—interstitial absorption still accompanying.

exercise of it, even when gentle. The affection is most likely to occur in those of weak frame, and is usually attributed to external injury. In general, dull uneasiness has been felt in the bone, before any affection of the soft parts became recognized. The treatment consists in gentle counter-irritation, rest of the affected part, and attention to the general health.

This morbid state of bone is found to be of importance, not so much on its own account, as in consequence of its being the precursor and accompaniment of one of the most troublesome diseases with which our art has to contend—caries (Fig. 51).

Continuous Absorption differs from the preceding in being continuous, instead of interstitial or ing usually both continuous and progressive, it occa loss of substance. It may follow, more or less rem nmatory process ; or it may be accompanied by some ut in many cases it seems to be almost wholly unconnected r change; and, in all, it is quite separate from true inflammation. The loss of substance is gradual, almost painless, and altogether without formation of pus; the work of absorption alone. And thus it manifestly differs most widely from true ulceration.

Fig. 52.



Continuous absorption illustrated by the pressure of an aortic aneurism on the bodies of the vertebræ; *a*, the arch of the aorta; *b*, the descending aorta; *c*, the vertebral column. Opposite *d*, the bodies of the vertebræ are seen excavated, with corresponding processes of the compressing clot; while the intervertebral substances, successfully resisting the pressure, project into corresponding depressions of the fibrin.

A similar difference is observed in regard to repair, or restoration of lost substance. A chasm of the soft parts may be filled up either by granulation, or by the "modelling process" (p. 176). The former is preceded by true inflammation, and is analogous to ulceration. The latter is not only unconnected, but incompatible with true inflammation, and is analogous to continuous and progressive absorption; the one is simple removal, the other simple deposit; both are unattended with inflammation, and both are consequently unaccompanied with the formation of pus. To both the absence of atmospheric contact is essential. Admit this, and inflammation follows—the consequence of sudden and powerful stimulus, acting on a part already in an unsound condition. The simple absorption is converted into true ulceration; the modelling process is arrested, ulceration overturns what has been already done towards repair, and then, this destructive process subsiding, restoration commences again in a new way, by granulation.

Familiar examples of this form of absorption are afforded by the gradual disappearance of texture, both hard and soft, before slowly increasing pressure; as in the case of abscess or aneurism. And pressure may be considered as by far its most frequent exciting cause. According to the amount of dose, this produces different effects. By sudden and great pressure, vitality may be at once destroyed in the part; a less amount gives ulceration; less, simple inflammation; less, a perverted vascular function short of the truly inflammatory; still less, gradually applied, with exclusion of atmospheric influence, affects the arterial and capillary vessels little if at all, while it excites the absorbent vessels to the morbid result now under consideration.

Treatment consists in abstraction of the cause—usually pressure—rest of the part, and moderate counter-irritation. The two first, and especially the first, are the most important, as can be readily understood; and when they have been satisfactorily fulfilled, but little of the last will be required. When the morbid condition has been arrested, the loss which it has occasioned is repaired, by the accession of its analogue the "modelling process;" simple non-inflammatory deposit coming in the place of simple non-inflammatory absorption.

See Canstatt, Die Specielle Pathologie, &c., Erlangen, 1841; Paget, Report, British and Foreign Medical Review, April, 1846, p. 564; also Lectures on Hypertrophy and Absorption, Medical Gazette, 1847.

CHAPTER VIII.

TUMORS.

PERVERTED nutrition has already occupied our attention, as a result of the inflammatory process; and also as inducing hypertrophy, induration, and other change of original structure. Under the present section, we have an example of perverted nutrition of a different kind, constituting Tumor; a morbid growth, or new structure, of slow and gradual progress, possessed of a formation and increase distinct from those of the original tissues, and usually independent of the inflammatory process, except perhaps as an exciting cause.

The *origin* of tumor i [illegible] nsettled. Some still assert that extravasation is the [illegible] at the extravasated blood, becoming organized, form [illegible] rigin of the morbid growth. What led to this suppositi [illegible] observation of the fact, that the morbid formation was [illegible] s attributable to the receipt of external injury. A pa [illegible] uck, extravasation followed, the extravascular blood w [illegible] otted, the hardness became less, but did not altogether disapp [illegible] a firm knot remained; this, after a time, began to enlarge; the increase continued, and permanent tumor became developed. But the proof afforded by morbid anatomy of the origin of tumors from coagula is, to say the least, very defective as regards the greater number of these growths; and this chain of events —of very frequent occurrence in connection with tumor—can be explained otherwise than by supposing organization, with subsequent growth, to take place in an imperfectly absorbed coagulum. Tumor is in fact always the result of perverted growth and nutrition; and its origin, in particular cases, must be owing to some predisposition either of the part or of the system. The latter indeed is frequently shown very plainly, by a tendency to the generation of numerous growths of the same kind in one individual. Now, any cause which in a person so predisposed leads to an interruption, even temporarily, of the normal function of growth in a part, must necessarily lay that part peculiarly open to the action of the predisposing causes of tumor. Such a perversion of the normal process occurs, when a blow or other injury leads to extravasation and inflammatory exudation. Under ordinary circumstances, this exudation merely accomplishes the wonted salutary end in view; namely, restoration of the continuity of texture, which the extravasation had broken up; and, on this end having been attained, redundancy of exudation disappears by absorption, and the normal condition of texture is more or less completely restored. But not unfrequently, the absorption is incomplete; a redundancy of fibrinous plasma, in process of organization, remains; formative action of the bloodvessels continues in an exaggerated though simple form, in the seat of exudation; the plasma is added to, while the surrounding textures are undergoing merely the quiet and healthful changes of ordinary nutrition; the swelling increases; and its growth is now distinct, and independent of the surrounding parts. This we believe to be the most frequent mode in which the simple tumor originates; not from the organization of extravasated blood; and not as a direct result of, or attendant on, the ordinary inflammatory process; but this and the extravasation being rather related to it, as the exciting cause. The blow and extravasation are followed by fibrinous exudation, the result of an exaggerated nutrition effected by the inflammatory process, with a restorative and salutary object in view; the exudation is redundant, and the excess is not wholly absorbed; continuance of deviation from the normal structure induces a continuance of exaggerated nutrition at that part; accumulation of organizable plasma results; and commencement of a new growth is established. If the morbid local increase of deposit be of a simple, fibrinous, and plastic character, a simple tumor results; but if, from constitutional vice, or other causes, it have departed from the ordinary fibrinous character, then the resulting tumor equally deviates from similarity to the original texture.

Tumors have been called *Analogous* or *Homœomorphous*, when their structure is of a kind resembling some normal texture; as fat, fibrous tissue, cartilage, bone—*Heterologous* or *Heteromorphous*, when they bear no similitude to the normal tissues; as carcinoma and melanosis. This division is certainly, in the present state of science at least, somewhat arbitrary; as there are several forms of tumor, the structural relation of which to existing textures is very doubtful, notwithstanding all the improved methods of investigation now in use. To the morbid anatomist it is evident, that some such classification is indispensable, however difficult; as it indicates the state of his knowledge of morbid structures, derived from minute and careful examination of their characters in the dead body, or after removal from the living. The surgeon, however, is under the necessity of looking for a classification, the elements of which are more within his grasp, and which can be serviceable to him ere yet the tumor has been subjected to his operations, or in any way interfered with. Such a classification has existed, in one form or other, from the most ancient periods; some tumors being universally recognized by surgeons as of peculiar danger in whatever part they occur, from their connection with an evidently constitutional affection, their tendency to recurrence after extirpation, and their irresistibly progressive and destructive march; hence called "*tumores mali moris*," or *Malignant tumors*. On the other hand, many tumors not presenting these characters are universally considered as *Benign* or *Non-malignant;* and although the classification founded on this distinction may, like all others, still prove arbitrary, and its application to some varieties of tumor involve not a few controverted questions, yet it is on the whole the most significant and practically important division which has been yet established.

Non-malignant Growths are such as do not consume the surrounding textures, by involving them in the same degenerated structure with themselves, but simply push them aside, condensing them into the form of an enveloping and limiting cyst; proving injurious chiefly by bulk and position; having no tendency to reproduction when thoroughly removed, and being unconnected with constitutional cachexy. *Malignant tumors*, on the other hand, efface the normal texture of the part in which they form, and ever seek their own extension by further change of surrounding textures into resemblance of themselves; they are connected with constitutional disorder; their bulk is not so injurious, as the pain, hectic, and exhaustion which attend on their advancement; when removed, there is no guarantee that they shall not be reproduced, in the same or another site; in one sense they are not themselves a local disease, but rather the local indications of a disease which has a constitutional seat and origin. Of the simple or non-malignant tumors, take the adipose, or the fibrous, as examples; of the malignant, the carcinomatous or the medullary. Others, again, may be considered as holding a middle place between the two great classes; having some of the characters peculiar to each. The tubercular or scrofulous tumor, for instance, is heterologous and dependent on a constitutional vice; yet it does not invade contiguous parts, and does not tend to the foul ulcers and fungous growths of the truly malignant formations.

With respect to structure, malignant tumors are in general heterologous, differing essentially from all the known tissues of the body; while the non-malignant are more commonly analogous, or similar to some of these tissues. The latter may present the appearance of fibrous tissue, fat, cartilage, bone, bloodvessels, &c.; and the different varieties of non-malignant tumors are in fact designated from the tissue which they resemble. On the other hand, the truly malignant growths, while presenting considerable varieties, have also general resemblances to each other, so strong as to entitle them, in the opinion of the best observers, to be considered as varieties of one disease, and as depending on the constitutional affection formerly described under the name of *Cancer* (p. 58).

The ultimate elements of structure observed in tumors, with the aid of the microscope, may be reduced to a very few. According to Dr. Bennett, and most other observers, they are chiefly molecules and granules, cells and nuclei, fibres and filaments, bloodvessels and crystals. Some of these are present in all morbid growths, in the most simple as in the most malignant; and much surprise has been expressed, that tumors of character so various should spring from elements so nearly identical. But those who are aware that all the varied forms of organic nature are developed from a few elementary types, very similar to those above mentioned, will not find in this circumstance any real difficulty or incongruity. It is in the grouping of these elements, in their relation to each other, and to the surrounding parts, and in the law of their development, that the pathologist finds the difference between one tumor and another. An intimate knowledge, therefore, of normal structures, as well as of all the usual forms of morbid growth, is required to enable any one to decide upon the texture of an individual specimen; and it is particularly to be noticed that this experience becomes the more necessary to guard against erroneous conclusions, when the microscope is brought to the assistance of ordinary vision; for it is not by the hasty examination of a few supposed characteristic elements, but by an elaborate investigation of the whole structure, that a satisfactory conclusion can in doubtful cases be obtained.

The *chemical constitution* of tumors varies; but not so definitely as the systematic writer could wish. The proximate animal principles which are chiefly found in them are—fat, gelatine, and albumen; and according as any of these predominates in the structure, the nature of the tumor is found to alter. Those which consist chiefly or wholly of fat, contained in an areolar parenchyma, are analogous, simple and non-malignant. Those which, by long boiling, are reduced almost entirely to gelatine, are also analogous and non-malignant. Those which consist mainly of albumen, include both analogous and heterologous formations; some are malignant, others simple; in the most malignant, as some forms of carcinoma, there is little or no trace of gelatine, and the composition seems almost wholly albuminous.

The great majority of tumors are enveloped by a *cyst*. In some—those specially termed Encysted—it is the original and chief part of the structure; by secretion from which, the interior and bulk of the tumor is produced; and in extirpation, the whole of this cyst must be either removed or destroyed, otherwise reproduction is certain. In others, as the adipose, the cyst is constituted secondarily, and consists merely of the ordinary areolar tissue condensed into a membranous appearance by the pressure of the enlarging tumor; it adheres loosely to the growth, and is to be regarded as no part of its structure; and when the tumor is removed, the cyst may remain, without any chance of reproduction. Certain tumors of a suspicious character, and yet not of avowed malignancy—as many examples of the cystic sarcoma—are enveloped in a stout cyst which is truly part of their structure, having become secondarily, if not originally, intimately incorporated therewith; and this cyst must be taken wholly away, if we wish the operation to be satisfactory and complete. The malignant tumors usually are limited by no cyst; it is their nature to invade and involve neighboring texture, and not to condense and push it aside. Sometimes, however, a fibrous expansion for a time resists the invasion, and, while so successful, assumes the place and character of an ordinary cyst. That, too, in extirpation, must be taken away, even though as yet not fully incorporated with the diseased structure.

In regard to the *degeneration* of tumors, or of their transition from the simple to the malignant type, there is a difference of opinion among surgeons; some, like M. Cruveilhier, holding this to be impossible. I cannot resist the conviction that it does occur. I have observed cases in which tumors, originally simple, have become malignant; fatty, erectile, and cystic growths have become medullary or melanotic. Again, I have found tumors, excised and bisected, consisting partly of non-malignant and partly of medullary structure; as if caught in the very act of degeneracy. Tumors, too, are found half carcinomatous, and half medullary; the hard scirrhus passing into the soft cephaloma.

Enchondroma, though seldom, yet has been observed softening and becoming medullary in its centre. And osteosarcoma, I am very sure, often passes into osteocephaloma. Simple ulcers, we know, not seldom become cancerous; and why may not tumors do the same?[1]

Degeneration may proceed from one of two causes; general or local. While a tumor is yet simple, the constitution may undergo an untoward change, cachexy becoming established; and the tumor will then gradually sustain a corresponding alteration. In this manner a tumor of the breast, originally of a non-malignant nature, may insensibly pass from the simple to the carcinomatous structure and tendency; the signs of degeneracy in the system preceding those of the evil change in the part. Or, on the other hand, t[illegible]ining apparently unchanged, the tumor itself degene[illegible]ce of repeated local excitement; as by blow, pun[illegible] malapraxis. The tumor's ordinary growth, as has [illegible]ed, is unconnected with the inflammatory process; but the tu[illegible]ucture, like other organized textures, whether original or secondary, is liable to assume that disease. When assumed, it may advance to the ordinary results. A recent simple sarcoma, or a tubercular tumor of any standing, may suppurate, and disappear by disintegration. A circumscribed tumor of any kind, sometimes, though rarely, is reduced to the condition of a slough, and may so be extruded, as it were by Nature's own operation. Ulceration is an extremely frequent result, in any excited tumor, and more especially in those of malignancy. These are clearly the results of the inflammatory process, of a high grade, in tumors. The more chronic and minor process is less marked in its operation, but equally decided and often more untoward in its effect. At first, it may cause mere acceleration of the growth, by increase of the same deposit as before; the tumor enlarges, but is yet of its original simplicity of structure. But after a time, the deposit changes; the morbid process is altered too; and the nutrition is not merely exalted, but perverted. The tumor then increases, perhaps more rapidly than before; but there is more than mere increase, there is degeneracy to boot; the simple passes rapidly, and with marked indications, into the malignant form. All tumors are liable so to change; but some more than others. Of the simple tumors, the cystic may be considered the most disposed to evil; while the fibrous evinces the least tendency to depart from its original nature. The exciting cause of change, when of the local kind, may be accidental injury; but much more frequently it is the repeated and ill-advised application of stimulus, wilfully, in the vain hope of discussing, by absorption, what is not amenable to such mode of removal.

Certain tumors may be made to disappear by *absorption;* and to these the cautious application of stimulus, with that end in view, is a commendable and safe procedure; but, unfortunately, these constitute but a small minority of true tumors. The simple sarcoma, a mere organized accumulation of fibrinous matter, may be discussed; and so may the scrofulous tumors. But all others resist discussion, and can be removed only by the knife. If the attempt to discuss be persevered in, nothing but evil results. 1. Their growth is accelerated. That is of itself an evil. The simple tumor, as such, proves injurious chiefly by its bulk and position; by accelerated growth that injury is obviously enhanced. At first the tumor, when small, could be removed by operation, with ease and safety to surgeon and patient; but, in consequence of the increased bulk, deeper and wider incisions become necessary, important parts are encroached on, and the operative procedure becomes one of difficulty and danger. 2. Adhesions are rendered both more numerous and firm. A fatty tumor, for example, uninterfered with, long remains very loosely connected with its delicate investing cyst, even when of large size; but after repeated stimulation the adhesions become so dense and numerous, as almost to incorporate the cyst with the tumor. At first, little more than a mere incision might have sufficed for removal; afterwards a painful, tedious, and careful dissection is required. Many a tumor has thus been brought not only into contact with important parts, but also rendered firmly adherent to them. 3. Degeneration is favored, by causing an exaggeration in the perverted nutrition, as has been already explained; nay, such degeneration may be not merely favored, but directly produced by the malapraxis, while neither tumor nor system had previously any disposition towards such untoward change.

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[1] The question is a difficult one. Practically, it is unimportant whether the pre-existent morbid structure *passes into* malignant structure, or whether the latter is *deposited in it*, and takes its place, as in normal tissues. What I contend for, is, that such malignant deposit and change are *more likely to happen* in tumor, than in normal primary texture; more especially under certain circumstances, as will afterwards be stated. And obviously important practical results hinge upon this.

Not unfrequently, however, discussive treatment may be applied with the best success, not as itself a means of cure, but as an adjuvant and preliminary to operation. Thus, a carcinomatous tumor may be of such enormous apparent dimensions as to render extirpation a proceeding of much danger, if not impossible; and had we no means of diminishing the bulk, and consequently limiting incision, we might be compelled to leave the patient an unaided victim of the disease. But we know that, in most cases, much of the bulk is not really due to the tumor itself, but consists of the common products of the inflammatory process in the areolar and other tissues exterior to it. By discussives, judiciously employed, that outer swelling may be absorbed; and the mass, then reduced to almost half its former size, may be dealt with by operation fearlessly. Let not the discussives, however, be persevered with or pushed so far as to attack the tumor itself; otherwise its morbid nutrition is excited, and the result is the opposite of that which we desire.

All tumors sympathize with excitement of the general system, and have their nutritive action proportionally augmented; as during febrile accessions, by sustained violent exercise, by mental emotion, and by occurrence of the menstrual period. At such times, too, as can be ly understood, degeneration is most liable to occur.

om what has been said, it follows, that long delay in actively treat-
true tumor—that is, by extirpation—is seldom if ever expedient.
ss it be of the simple or scrofulous kind, it cannot be removed by
ption; meanwhile it is, though perhaps slowly, steadily enlarging,
iring deeper and more important relations, and forming new and
intimate connections; besides, it is every day liable to commence
process of transition into a structure and tendency of a more sinister

kind. If the system be in evident disorder, if the part be in a state of temporary and accidental excitement, or if the bulk be great and not wholly dependent on the tumor—delay is advisable, until correction have been made so far as circumstances will permit. But, this having been achieved, means suitable for efficient removal cannot be too soon adopted.

Spontaneous cure sometimes occurs. 1. By absorption. We have already seen in what cases this mode of disappearance may be effected by art; it sometimes, but rarely, occurs spontaneously. 2. By suppuration and ulceration. A simple tumor, as a scrofulous, may inflame; and, suppurating to the core, may crumble down by disintegration; or ulceration may commence on the surface, and gradually extend to the interior; the parts subsequently healing by a depressed and tight cicatrix. By the same process, it will be seen, an erectile tumor may disappear, partly by loss [illegible] by condensation of what remains. 3. By sloug[illegible]nscribed tumor may be so extruded. Not by the [illegible] n the tumor itself, having proceeded to its ulterior [illegible] sequence of diffuse purulent infiltration having taken [illegible] ding areolar tissue, whereby that tissue sloughs. The tumor, deprived on all sides of its vital supply, rolls out, an inanimate mass. 4. By enucleation. When the tumor is loosely attached to the surrounding parts, like a fibrous tumor to its cyst, Nature sometimes procures its extrusion through an ulcerated opening in the latter; and the surgeon, following Nature, may endeavor to produce this process by the application of caustic to the exterior of the cyst. This proceeding is occasionally adopted in fibrous tumors of the uterus. The two first modes of cure, as well as the last, may be, and occasionally are, successfully imitated. The third is a rare occurrence in Nature; and, like all diffuse infiltrations, being attended with no inconsiderable danger to both part and system, it cannot be imitated with safety.

Tumors also are found to vary, as to the power and probability of *reproduction.* Some have no such tendency. The simple tumors, taken wholly away by operation, are seldom if ever reproduced in the same site. Some may have even a part left behind, and yet fail to grow again; a simple sarcoma, or an adipose tumor, has sometimes been but partially removed—yet the cicatrix has become firm and permanent, and no subsequent increase has supervened. As a general rule, however, it is well to hold, that, in even the simplest formations, the whole of the morbid structure must be removed; so as to render it certain that reproduction shall not ensue. In all malignant growths, that rule is most imperative; the slightest fragment of the morbid structure remaining, is sure to become the root from which a fresh formation will speedily arise.

Tumors, as we have seen, are very various in their nature; and occasionally examples present themselves, differing from any of the classes usually described. It is impossible to construct a *classification* which shall embrace every growth. We attempt only that which may include the majority; arranging them, also, in a form at once convenient for description, and suitable for enforcement of the practical details of treatment.

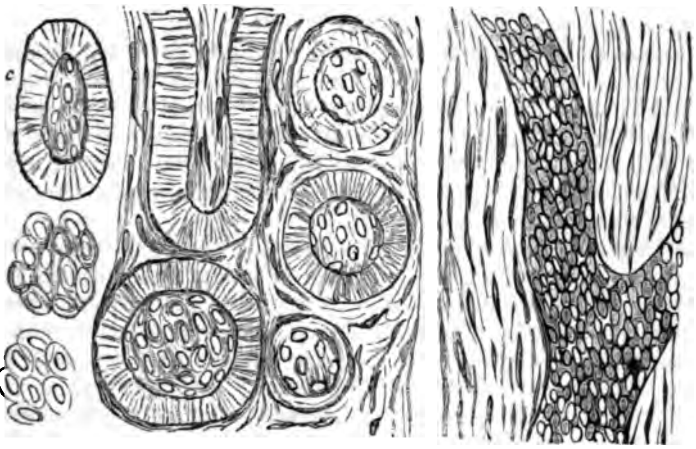
Tumors are *Solid;* consisting of a more or less compact fleshy growth, whose enveloping cyst is entirely of secondary formation. Or they are *Encysted;* the cyst the original structure, and its secretive power maintaining the bulk and increase of the morbid growth.

The solid tumors, again, are *Simple* and *Malignant.* I. In the former class are the *Simple Sarcoma*, the *Fibrous*, the *Adipose*, the *Cartilaginous*, the *Calcareous*, the *Osseous*, the *Cysto-sarcoma.* II. There is a tumor locally simple, but accompanied with and dependent on a constitutional vice; the *Tubercular.* III. The *Malignant* are the different varieties of Cancer—*Carcinoma*, *Medullary Tumor*, *Fungus Hæmatodes*, *Colloid Cancer*, and *Melanosis.* These solid tumors of the soft parts we shall consider in detail.

I. *Non-malignant Tumors, without Constitutional Cachexy.*

1. THE SIMPLE TUMOR, OR SIMPLE SARCOMA.—There is reason to think that many of the tumors called sarcomatous, and included under the "common vascular sarcoma" of Abernethy, are in reality hypertrophies or alterations of structure, in some glandular or other organ, the original characters of which become more or less completely lost to the naked eye, although they may be recognized by the microscope. Mr. John Birkett has lately shown that many of the simple tumors of the mammary gland, or chronic mammary tumors of Sir A. Cooper, are of such a character. The annexed wood-cut from Dr. Bennett's work will also convey an idea of a tumor of this kind, in which every element of the healthy structure of the gland is present, although with more or less modification as to quantity. Similar diseased conditions of the greater internal glands are well known to pathologists; although the extreme

Fig. 53. Fig. 54. Fig. 55.



This series of diagrams represents microscopic sections of a simple tumor removed by operation from the female breast; consisting mainly of hypertrophy of the fibrous structure of the gland, with enlargement of the included ducts and their epithelial linings.

Fig. 53. *c*, Section of the epithelium from one of the tubes. *b*, Group of epithelial cells from the same. *a*, The same after the addition of acetic acid. Fig. 54. Thin section of the same tumor, after the addition of acetic acid. Fig. 55. Another section transverse to the former, similarly treated.—BENNETT.

forms of such degenerations are of course inconsistent with the life of the patient.

Occasionally, however, it happens that tumors distinct from any special organ, and not containing the elements of any specific or complex tissue, are formed entirely of elements similar to those observed in granulations and other new structures. Such tumors have a homogeneous, or indistinctly fibrous structure, to the naked eye; and have every variety of consistence. Under the microscope, cells and fibre-cells similar to those in Figs. 15, 16, 17, or to those of granulations (Figs. 26 and 27), are observed in great abundance, and appear to constitute the whole bulk of the tumor. These tumors are commonly enclosed within a cyst or investment of ordinary areolar texture, and may themselves be considered as probably merely a nascent condition of some of the fibrous growths to be hereafter described. They are called by Lebert fibro-plastic growths; but have been included by most British authors among the simple sarcomata. They have not the extreme density of the confirmed fibrous tumors, and in their external characters resemble those formed by alterations of glands, as indicated in the preceding paragraph.

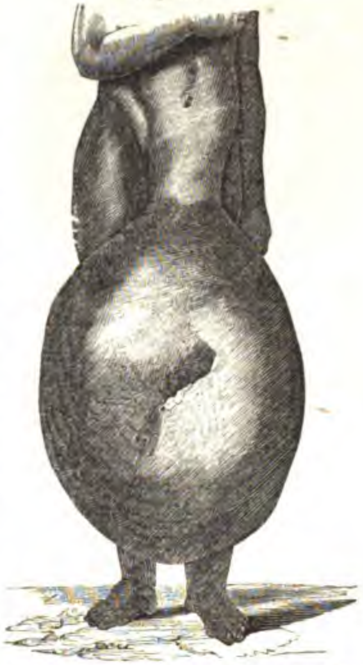
It has, indeed, been doubted whether some varieties of these fibro-plastic growths would not be more properly classed among the malignant tumors, as they have occasionally been found to be prone to return, after excision, with singular obstinacy. Mr. Paget believes that he has observed two varieties of these tumors, one of them simple, the other approaching in structure towards the cancerous type. M. Lebert, on the other hand, places the whole class among the "cancroid growths," and denies that the tendency to return furnishes any sufficient evidence of a cancerous origin. Further observations are evidently required to determine their true pathological position.

The class of the simple sarcomata is certainly not a well-defined one, but it is retained in the meantime in deference to considerations of a practical kind, as the external marks of the growths above described are insufficient to distinguish them from one another, while they form a group distinct enough from those of which we have to speak hereafter. Of all the simple sarcomata, the fibro-plastic tumors alone present any tendency to become malignant.

The diagnostic characters of the class are, a smooth surface—except when one or more such tumors are in connection, as sometimes happens in regard to lymphatic glands—although these, as already stated, are infinitely more liable to mere inflammatory enlargement than to the formation of a real tumor; a tolerably firm yet doughy feel; no fluctuation; no elasticity simulating fluctuation; little or no pain, on even free manipulation; looseness of connection, and no implication of adjoining parts; a steady, painless increase of bulk, more tardy than the growth of abscess, or of inflammatory enlargement, or of malignant formations; no indication of a higher amount of vascularity than what a similar bulk of the normal texture would naturally be expected to possess. The size may vary greatly; some are but small; others have been found, after many years' growth, seeming as if a second body, and weighing many tens of pounds.

Treatment.—Some sarcomatous tumors are undoubtedly capable of being removed by discussion, as the mode of their origin from glandular organs, above mentioned, will at once indicate; more especially while yet recent, and scarcely removed from their first or nascent stage. The part is to be placed and kept in a state of comparative, if not of absolute repose. By moderate but repeated leeching from the vicinity of the part, the morbid nutritive process is diminished or wholly arrested; and then, by counter-irritation, and stimulation of absorption, gradual retrocession is patiently expected. Gentle blistering may be employed; or iodine, in the form of ointment or solution; or mercury, in ointment; or pressure; or plasters of galbanum, ammoniac, mercury, or other discutients. At the same time, the state of the general health should be seen to; and iodine may be administered internally. The local stimulation is proceeded with warily, lest vascular excitement ensue, and the tumor grow more rapidly than before; if so, rest and depletion must be again employed.

Fig. 56.



Example of simple tumor, of enormous size. Hypertrophy, or elephantiasis of the scrotum, in a Hindoo.

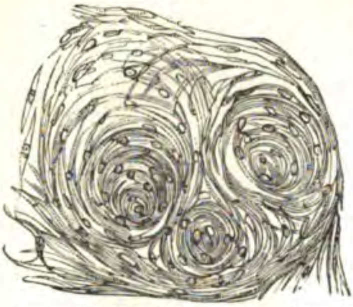
By carrying the vascular excitement to a higher grade, however, removal may be obtained; by suppuration of the interior; by ulceration extending from the surface; or by sloughing of the whole, in consequence of diffuse areolar infiltration around, as was formerly shown (p. 268). These, however, are circumstances to be watched and taken advantage of, when they occur spontaneously; not to be artificially induced; unless at the express and urgent desire of the patient, when the tumor is of small size, and when it is not situated in the neighborhood of important parts.

In such sarcomatous tumors as constitute the early stage of fibrous growths, it is probable that discussion is never really effected; and where the means above mentioned have been tried and failed, extirpation by the knife is to be had recourse to, at a yet early period; before any great size has been attained; when the morbid structure is yet loosely connected with the surrounding parts; when no deep-seated and important vessels, nerves, cavities, or canals, are yet in close contact; and ere any opportunity has been afforded for degeneration.

2. The Fibrous Tumor.—A great variety of tumors may with propriety be termed fibrous; in fact, fibrous tissue is a constant element of all growths; and many of them are entirely composed of it. We have already seen that some of the sarcomatous tumors are formed of fibrous tissue, in an early stage of formation; and in addition there occur

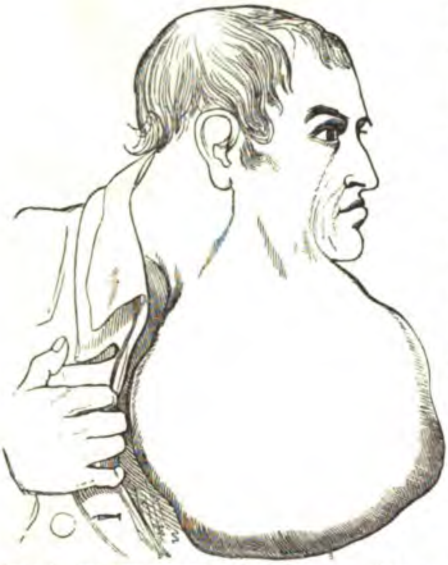
others, of slower growth and firmer consistence, in which this tissue is much more highly developed; constituting a mass of interwoven glistening white fibres, of a most characteristic appearance. Such tumors are common in the uterus, where they may attain the size of an adult head. They are sometimes called *Desmoid*, from the resemblance of their fibres to those of ligament (δεσμος); to the structure of which indeed they approximate very closely, whether viewed by the unaided eye or by the microscope. The fibres are mostly rendered very transparent by acetic acid, at the same time swelling up and revealing nuclei, which are sometimes oval, and sometimes elongated. Not unfrequently, in the midst of the fibres are found small extravasations of blood, the origin of which is not well understood, as the vascularity of these tumors is very inconsiderable. By protracted boiling, fibrous tumors are almost entirely resolved into gelatine.

Fig. 57.



Section of a desmoid fibrous tumor from the uterus after the addition of acetic acid.—BENNETT.

Fig. 58.



Large fibrous tumor growing from the neck. Was successfully removed.

Some varieties of the fibrous tumor are interesting and important. In the uterus, and elsewhere, they often become the seat of calcareous deposition to a very great extent; and may thus assume an almost bony hardness. The deposit is however quite amorphous, and has none of the characters of true bone. Some tumors, also essentially fibrous, have more or less of the dense, compact, homogeneous, character of cartilage; and these are called by Müller *Chondroid*. They can commonly be distinguished from cartilage, even by the naked eye; and always by the microscope.

The diagnosis of fibrous tumors is ordinarily not attended with much difficulty. They are the most dense and firm of all simple tumors of the soft parts. Their shape is irregularly globular, their surface being frequently nodulated. The investing cyst is thick and strong, presenting a smooth surface to the tumor, with which it is slightly connected. They are perfectly circumscribed, movable, and independent of the tissue in which they appear. They may occur in any situation; but are most frequently found in the neck, in the vicinity of the mammary and parotid glands, and connected with the uterus. They are painless; slower in growth than any other tumor, and the least liable to change in structure or tendency. They are consequently inconvenient only by their bulk; and by the uneasy sensations, and interruption to function, which their compression of neighboring parts may occasion.

Lately, it has been asserted that the fibrous tumor never degenerates; and that, as it is also of slow growth, it need not be made the subject of operation, early, or at all. This, however, seems to be an exaggeration of the fact. It is slow of growth as a fibrous tumor, and is little prone to abandon that character; but age of the patient, and accidents of the system, duration of the tumor, and its frequent stimulation, may force even the fibrous structure into degeneracy, and rapidity of untoward advancement. Let extirpation be had recourse to, while the tumor is yet small, simple, and free. No hope need be entertained of absorption.

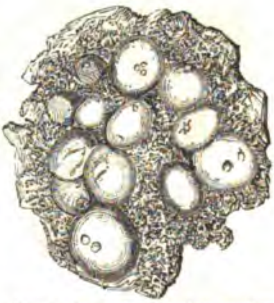
3. Fatty Tumors.—Fatty matter occurs in morbid growths in several microscopic forms; of which the chief are, 1st. Crystals, laminated, or radiated and acicular (the former being cholesterin, the latter margarin). 2d. Molecules, granules, and globules, which are of very frequent occurrence in almost all morbid structures, and are chemically composed of olein holding margarin in solution, and accompanied by more or less albuminous matter. 3d. Disposed in distinct cells, like those of normal adipose tissue. The first two forms here mentioned are peculiar to no special kind of tumor; occurring in both simple and malignant formations; and found in great abundance in encysted growths, where it is entirely extra-vascular and undergoes no further organization. A form of tumor of not very common occurrence, and described by Müller under the name of Cholesteatoma, consists of fatty matter, chiefly in the first two forms, and also contained in very thin imperfectly organized cells. The matter thus formed is of the consistence of tallow, and is deposited in successive layers in the interior of a thin cyst, forming a laminated mass, having a lustre like mother-of-pearl, and entirely without vessels. This must be regarded as a variety of encysted or steatomatous growth.

The true adipose tumor, or *Lipoma*, is composed of cells exactly resembling those of the normal fat, interspersed amid areolar tissue, which is pervaded by bloodvessels; although the supply of blood to this form of tumor is by no means very large.

The fatty tumor is commonly limited by a fine membranous cyst of areolar tissue. Sometimes, however, the growth is of a diffused character, without any marked distinction between the surrounding parts. Not unfrequently, the integument has undergone hypertrophy, as well as the subjacent tissue.

The lipoma is the most frequent form of fatty tumor. It is always lobulated, usually in all its aspects, and irregular in form; flat, glo-

Fig. 59.



Fat cells and granular matter, from a steatomatous tumor of the ovary.—Bennett.

bular, cylindrical, according to circumstances. The sensation imparted to touch is one of elasticity, closely simulating fluctuation, and requiring the *tactus eruditus* to solve the difficulty. Manipulation is quite painless; the integument, if not hypertrophied, is pale, slack, and freely movable on the tumor; and this, too, is loose upon the parts beneath, at least in the first instance. When the growth has been of long duration, and attained to great size, both skin and tumor become more fixed; the former being stretched over, and partly incorporated with, the bulky mass; and the latter having sent forth its lobules deeply, into the intermuscular spaces. Growth is gradual and steady; more rapid than that of any other simple tumor, yet slower than that of any malignant swelling for which it is likely to be mistaken. The most common sites are the thighs, shoulders, neck, back, abdominal parietes, and labia pudenda. Sometimes the tumor is of a pedunculated character, projecting from the general surface, and attached by a narrow neck.

Fig. 60.

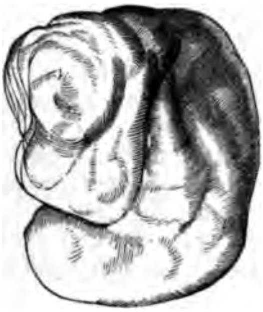


Fig 61.

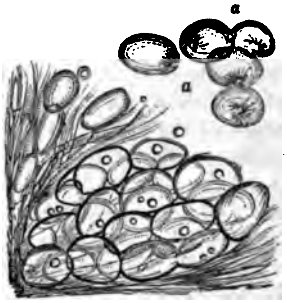
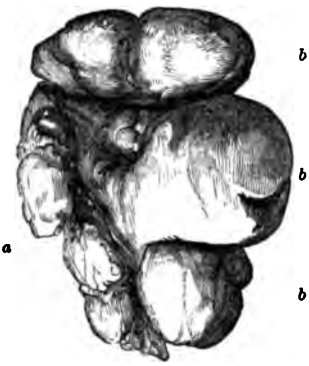


Fig. 60. Fatty tumor, removed from a cyst under the tongue. Cholesteatoma. It was as large as an orange. Fig. 61. Structure of a fatty tumor removed from the back. Lipoma. *a*, Isolated cells showing crystalline nucleus of margaric acid.—Bennett.

Fig. 62.



Lipoma lobulated. At *a*, the mark of incision seen, in removal; *b*, *b*, *b*, the various lobuli.

The swelling for which it is most apt to be mistaken, is abscess. Tactile examination usually suffices for the experienced. Besides, there is the history of the case; all signs of inflammatory excitement are absent during its progress; the skin is pale and loose; there is no œdematous swelling around, unless the size of the tumor should interfere with lymphatic return; and this it seldom does, usually occurring on the outside of the limbs.

It is in vain to attempt discussion of this tumor; nothing but harm can ensue; enlargement, adhesion, degeneration (p. 266). A seton has been used; in the hope of exciting disintegration by thorough suppuration. But the result will prove unsatisfactory; and besides, the procedure is fully as severe as the appropriate treatment—extirpation. This should not be long delayed; for although the fatty is among the most simple of tumors, and little prone to change either in structure or in tendency, yet examples are not wanting of stimulation, long continued, having succeeded in effecting complete medullary and malignant degeneration. Besides, the lobules are apt to extend deeply, as already stated; and, even in the original state, an operation may thus be rendered difficult and dangerous. It is good surgery to advise and execute extirpation by the knife, so soon as we are satisfied of the existence of such a tumor, and the patient has been convinced of the expediency of the operation. A free incision having been made through the integuments and cyst, the elastic swelling starts outwards; and no regular dissection is required, as in other tumors; the fingers, aided by an occasional touch of the knife, usually suffice for removal. After incision, evulsion is often a more appropriate term for the proceedings, than extirpation or dissection; unless malapraxis have produced adhesion and incorporation with the adjoining parts.

4. THE CYSTIC TUMOR, OR CYSTO-SARCOMA.—Many of the malignant tumors contain cysts; but to these this term does not apply. Cysto-sarcoma designates a tumor partly composed of solid structure, partly of cysts or cavities variously occupied. The solid structure, or stroma, is of a simple and non-malignant kind, analogous to that either of the simple sarcoma, or of the fibrous tumor. The cysts are not mere vacant spaces, caused by breaking down of the solid matter, as often happens in the malignant formations; but are part of the original structure, lined with a distinct secreting membrane, and occupied by contents of various kinds. These are usually more or less fluid; sometimes a clear, glairy liquid; sometimes a gelatinous, pale mass, of semi-solid consistence, elastic, and projecting beyond the level of the cut cyst on a section being made; sometimes solid, consisting of a fibrinous deposit, organized very imperfectly if at all; sometimes of an atheromatous, or pappy istence, as in many encysted tumors. Sometimes, but more rarely, luid, like printer's ink, is contained; sometimes blood is mingled ts, either in the solid or in the coagulated form; but such

Fig. 63.

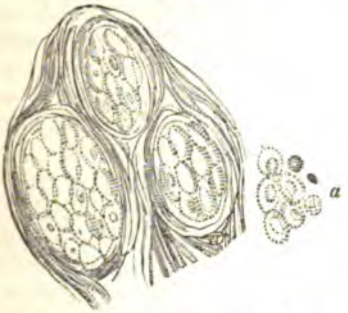


Fig. 64.

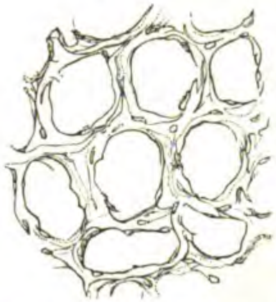


Fig. 63. Fibro-cystic structure, from cystic tumor of the breast, successfully excised. The cysts contain fibro-plastic cells. *a*, A few of the latter after the addition of acetic acid. Fig. 64. Fibrous structure with loculi, in another portion of the tumor, after the addition of acetic acid.—BENNETT.

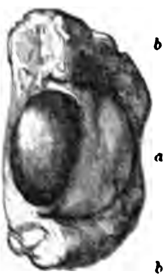
appearances are usually indicative of, and coeval with, degeneration of the tumor towards malignancy. Sometimes the cysts are numerous and small; in other cases, they are few and of large size. Sometimes they are single in themselves; sometimes many smaller cells are contained within a parent, attached by narrow peduncles. In the latter case, the tumor has been called *cysto-sarcoma proliferum;* in the former, *cysto-sarcoma simplex.*

Fig. 65.

Example of cysto-sarcoma; from the breast. At *a*, the cysts many; distinctly lined by a secreting membrane, and filled with a glairy fluid. At *b*, a section made on another plane; cysts less numerous.

Müller has described a third variety, which he terms *cysto-sarcoma phyllodes.* "The tu- [illegible] ge firm mass, with a more or [illegible] ce. The fibrous substance [illegible] a greater part of it, is of [illegible] olor, extremely hard, and as firm as fibro-cartilage. Large portions of the tumor are made up entirely of this mass, but in some parts are cavities or clefts not lined with a distinct membrane. (An exception to the general rule in cystic tumors.) These cavities contain but little fluid; for either their parietes, which are hard like fibro-cartilage, and finely polished, lie in close apposition with each other, or a number of firm, irregular laminæ sprout from the mass, and form the walls of the fissures; or excrescences of a foliated or wartlike form sprout from the bottom of the cavities, and fill up their interior. These excrescences are perfectly smooth on their surface, and never contain cysts or cells. The laminæ lie very irregularly, and project into the cavities and fissures like the folds of the psalterium in the interior of the third stomach of ruminant animals. Sometimes the laminæ are but small, and the warty excrescences from the cysts very large, while in other instances both are greatly developed."

Fig. 66.



Cysto-sarcoma simplex: from the neighborhood of the mamma. One large cyst, *a*; at *b*, the solid part of the tumor—a simple stroma.

The origin of the cystic formation is by no means well understood. It is almost always found in a naturally secreting structure, of which it is no doubt a transformation, probably by partial obstruction and obliteration of portions of the secreting tissue. Occasionally cysts are of parasitic or *hydatid* origin; but few surgical cysts are thus formed, except in the bones, and areolar tissue. There is no certain mode, previous to extirpation, of distinguishing hydatid from ordinary cystic formations.

Cysts may occur in any situation: but are most frequently found in the generative organs; in the testicle; in the female breast; and in the ovaries, or their immediate vicinity. Cysts are also not uncommon beneath the skin; and in the kidneys, liver, spleen, and other internal organs.

The cystic tumors are of no certain shape: but approach more nearly and frequently to the globular than to any other form. The integuments are not implicated in the morbid structure; yet usually show more or less of discoloration, especially at the points where the cysts are placed.

The feel is unequal; at the cysts there is fluctuation, more or less distinct—the more distinct the larger the cyst and the more fluid the contents; at the solid parts the handling is as of a simple sarcoma, or as of a fibrous formation.

Cystic tumors are non-malignant; but are especially liable to degenerate; no doubt in consequence of the independent secretive power which the cysts possess, and which may at any time take on a perverted and depraved character. Hence, there can be little doubt as to the propriety of early removal by operation.

The following tumors will be better described in connection with the particular tissues and parts where they occur:

5. THE CARTILAGINOUS TUMOR.—Cartilaginous formation, *Enchondroma* of Müller, occurs more frequently in bone than in the soft textures. The nature and tendency are simple; yet degeneration is possible, while discussion is impossible; and therefore early extirpation is expedient.

6. THE CALCAREOUS TUMOR, also comparatively rare, is most frequently found in the face and neck—especially in the former situation, in the vicinity of the parotid gland. In most cases, the stroma of the earthy deposit would seem to be the hypertrophied texture of a lymphatic gland. The tumor is superficial, loose, painless, hard, of slow growth and small size; its surface is generally unequal. It has no tendency to degenerate; being in fact but a mass of unorganized matter. Absorption, however, is hopeless; and removal may become expedient on account of the inconveniences attending its position. From the circumscribed form, small size, and lightness of adhesion, the dissection is easy; little more than simple incision is required.

Fig. 67. Fig. 68. Fig. 69.

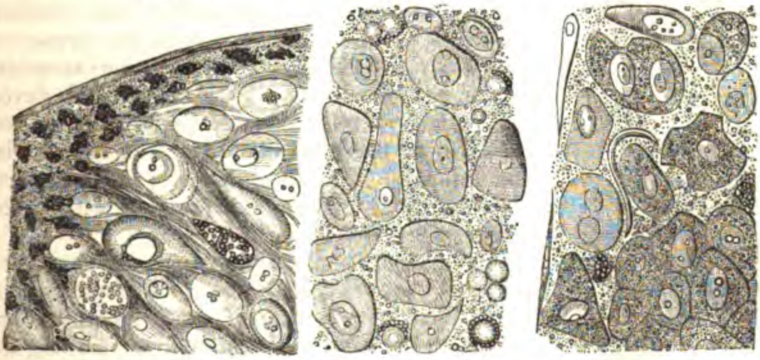


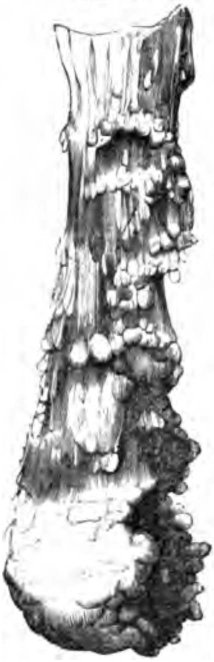
Fig. 67. Thin section of the circumference of an enchondroma from the pelvis. Fig. 68. Corpuscles from the softened part of the same tumor. Fig. 69. The same after the addition of acetic acid.—BENNETT.

Calcareous formations are found in the ovary, in the testicle, in the lung, and wherever in the body exudation takes place of a kind which cannot be all reabsorbed. We have already seen that in fibrous tumors calcareous deposit often takes place, in their advanced stages, in the midst of the fibrous tissue which it gradually supplants.

7. OSSEOUS TUMORS are most commonly found in connection with bone, but sometimes form in considerable numbers in fibrous structures, either normal or adventitious. They also occur in enchondroma. Care is necessary to distinguish them from the calcareous tumors, which they sometimes resemble to the naked eye.

II. 8. THE TUBERCULAR OR SCROFULOUS TUMOR.—This tumor, as already stated, may be regarded as occupying a middle place between the simple and malignant formations. The constitutional vice is that of scrofula. The peculiar de in the first instance, probably interstitial; subseque in masses of considerable size. It may occur in the tissue; its most frequent site is the glandular organs, l d secreting, but especially the former; in the latter, its charact usually most distinct as a genuine tumor. In the testicle it is very common. The nature and progress of the deposit is similar to what was formerly described, when treating of scrofula (p. 54). The tubercle is at first crude, and perhaps remains so for a long period, either stationary, or gradually increasing in bulk; then suppuration takes place, slow and imperfect; involvement of the integuments follows, with opening and discharge; and, lastly, the ordinary characters of the scrofulous sore are presented. Section of the mass shows a homogeneous structure, whitish, soft, granular, not truly organized, devoid of vascularity; sometimes surrounded by a very distinct cyst; sometimes not; the formation having been rather by interstitial deposit; in some parts, probably, broken down, and mingled with a non-laudable purulent formation.

Fig. 70.



Portion of a large abdominal tumor, composed of tuberculated omentum.

This tumor, in its early stage, is capable of removal by absorption; under the ordinary means, but especially by the use of iodine and its preparations, both externally and inwardly. Failing this it may be got rid of by central suppuration and disintegration; often a spontaneous process; and one which can be artificially induced, as well as accelerated and made more effective when of spontaneous occurrence. Not unfrequently, the suppuration is but partial; a portion of the morbid structure has come away, but the rest remains in an indolent state, tending neither to efficient reproduction nor to further decay. Under such circumstances, the potassa fusa is highly available; a portion being thrust into the centre, and throughout the tumor in various directions; not so much with the intention of converting the morbid structure into an immediate slough, as of insuring its thorough softening and disintegration. Subsequently, uniform and sustained pressure is of use, in favoring consolidation of the chasm, and obtaining a firm and sound cicatrix. It need scarcely be added, that constitutional management, with a view to removal of the general disorder which has led to the local change, is of paramount importance. And it is also obvious that in consequence of the co-existence, and in most cases the pre-existence as well, of the constitutional vice, no certain immunity from relapse can be predicated from any treatment, however active and suitable, directed against the local malady alone.

Extirpation of lymphatic ganglia, as formerly stated (p. 58), is never warrantable, when the subject of either simple or tubercular enlargement. Discussion or suppuration suffice for the cure. In the secerning glands, however, it is sometimes otherwise; more especially in the testicle. Here, a scrofulous tumor occasionally resists the ordinary modes of treatment; and, hectic having set in, amputation of the diseased part may be demanded.

Scrofula is very frequent in this country; so is one of its local signs, the scrofulous tumor. It is known by the usual characteristics of tubercular deposit; congested and discolored integument, and indurated enlargement beneath, with the general signs of cachexy; afterwards, more plainly, by the scrofulous ulcer and discharge (p. 53, &c).

It has been alleged that the scrofulous diathesis is incompatible with the cancerous. If such be the case, this is the only circumstance which can be adduced in favor of the scrofulous tumor.

III. *The Malignant Tumors.*

We now leave simplicity and analogy of structure, with benignity of character, wholly behind; and come to heterologous formations, truly malignant. These change altogether the original texture; invade the surrounding parts, converting them into a similar structure with themselves; and extend not only by continuity, but remotely, by the lymphatics; the lymphatic ganglia enlarging, not so as to constitute a mere hypertrophy, but a production of the same kind as the original tumor; and the system is involved in a cachexy, too often insuperable, whereby reproduction of the disease is rendered in the highest degree probable.

Malignant tumors generally abound in cell-formations, and in blood-vessels; hence in all probability their rapid growth and quick disintegration. The cells are commonly infiltrated into a fibrous structure; which is sometimes however in very small quantity, as in the softer varieties of medullary tumor. The cells observed in malignant tumors present not unfrequently a very high degree of development; containing one or more nuclei, of large size as compared with those of normal cells; and these again containing nucleoli. In some cases, even a fourth or fifth generation has been observed, in the interior of the "parent cells;" the development being supposed to be endogenous (Fig. 5, p. 59.)

Much stress has been laid on these characters, as affording a specific distinction between malignant and simple forms of growth. Lebert, in particular, has described the "cancer-cell" as quite characteristic and specific.[1] On the other hand, Müller asserts the impossibility of distinguishing the cell-element of cancer, in all cases, from the cells in certain other abnormal and even normal tissues; and Dr. Bennett agrees with him in considering no single element as characteristic of the former. We must therefore find the characters of malignant formations in relative or comparative considerations; especially the abundance of their cell-growths, the high development (in some cases) of the cells, and the encroachment of the growth upon the normal elements of the part. In places where few or no cells naturally exist, the profuse generation of these, in a tumor not presenting inflammatory characteristics, will of itself be strong presumptive evidence of cancerous formation: and if these cells present the high type of development above described, the evidence will be complete.

Fig. 71.

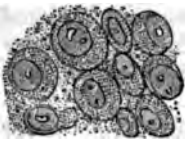


Fig. 72.

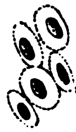


Fig. 73.

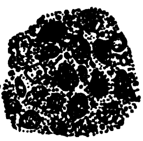


Fig. 71. Cancer cells in progress towards full development. Fig. 72. The same acted on by acetic acid. Fig. 73. Corpuscles and granules from the same tumor, in progress towards decay. Perfect cancer cells are represented in Figs. 75, 77, and also at p. 59.—BENNETT.

The cells of malignant growths are commonly associated with a viscid, whitish, or yellowish fluid, which can be squeezed or scraped in considerable abundance from the surface of a section. This creamy fluid is very characteristic, in general, of such tumors; and distinguishes them especially from the fibrous growths, which are dry in section, and yield only a minute quantity of serum or blood on pressure.

In parts naturally abounding in varied cell-growth, as in the glandular, epithelial, and epidermic tissues, the detection of malignant tumors by examination of their cells is often very difficult; and extreme caution, with attention to collateral circumstances, must be employed. In very many cases, indeed, a decided opinion can only be founded on an accurate knowledge of the structural elements, combined with a careful consideration of the whole general and local characters of the disease.

Malignant growths present so many elements in common, as to have led to their being considered varieties of one disease, and attributed to the cancerous cachexy already described (p. 58). In fact, the varieties, which we shall have to specify presently, run into one another by characters so insensible as to justify this conclusion. Nevertheless, it is proper to distinguish at least four species of malignant or cancerous disease; 1st, the carcinoma or hard cancer; 2d, the medullary or soft cancer; 3d, the melanotic or black cancer; and, 4th, the colloid or areolar cancer—all forming tumors which require notice from the surgeon.

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[1] Since the above statement of Lebert's opinion was made in the last edition of this work, the views of that eminent observer have become remarkably modified, as appears from his treatise "Des Maladies Cancereuses et des affections curables confondues avec le Cancer," Paris, 1851. He now admits that in certain malignant tumors (a small proportion, indeed) the specific cancer-cell is not to be found; and that in other cases it cannot be distinguished from other cell-elements, without taking into consideration the collateral tissues. These admissions place M. Lebert very much in the same position as his predecessor Müller; and show more clearly than anything else can do, the groundlessness of the strong statements that have been put forward as to the absolute histological characters distinguishing the malignant from the non-malignant growths.

9. CARCINOMA.—This is the occult malignant tumor, whose open condition is termed *Cancer*.[1] Scirrhus is a synonyme; but, as a term, has been so much abused, that it is well to exclude it altogether from our nomenclature. At one time, every hard swelling was termed a scirrhus, whether carcinomatous or fibrous, simple or malignant; and the inevitable result was much confusion and error, in both the pathology and treatment of tumors.

This tumor may be either secondary or original. Much more frequently it is the latter; secondary formations, by degeneracy, being usually of the medullary form.

When primary, as it generally is, carcinoma has a small, firm origin, and steadily increases; usually with much pain from the beginning, of a sharp and shooting kind. The hardness, to the touch, is often greater than in any other tumor, excepting the fibrous; it is stone-like. Weight also is great, in proportion to the bulk. The form is not globular and distinct, like that of the fibrous; but flattish, irregular, and gradually lost in the surrounding texture; at least without any abrupt or distinct margin of separation. The growth of the tumor is not rapid; greater than that of the fibrous tumor, but less than that of the other simple formations, and infinitely slower than that of the medullary. And it may be stated, as a general rule, that the older the patient, the slower the growth. In the comparatively young—say forty—months may suffice for far advancement; and in the old—say seventy—years may have passed away, with a tumor yet hard, small, occult, and but little painful. When the tumor forms in the substance of an organ, as the mamma, the original texture may seem to grow smaller as it grows hard; the tumor slowly increases, and at the same time the normal texture around shrinks by interstitial absorption. As the surface is approached, the intervening textures are involved in the morbid structure, and the skin is ultimately incorporated, becoming dark-colored, dense, depressed, and adherent; and this usually happens at a comparatively early stage.

At first, the tumor is movable; but ultimately, by incorporation with neighboring parts—skin superficially, and muscle beneath—it becomes fixed. By gliding with the muscle, however, to which it is attached, over the subjacent bone, mobility may be simulated; a carcinomatous mamma, for example, fixed deeply in the pectoral muscle, may, from this cause, seem wholly superficial to it; and careful examination is required for accurate diagnosis in this respect. Sometimes the carcinomatous passes into the medullary, either wholly or in part; then the characters of the former are merged in those of the latter; the tumor becomes soft, prominent, and elastic, growth is rapid, and the size may become great. A cachexy attends on carcinoma, as on all other forms of cancerous disease (p. 58, &c.); it is evidenced by emaciation, a marked sallowness of countenance, and sometimes by irregular hectic fever; but this last symptom is not usually distinct, until emaciation has begun. The disease seldom makes its appearance until mature age; rarely before thirty; more frequently after at least ten years more have elapsed. Females are more liable to it than males; and the females who have borne no children are more likely to suffer than those who have been often pregnant. The mamma, uterus, testicle, lip, skin, and mucous surfaces, are the most frequent sites; and most especially the first.

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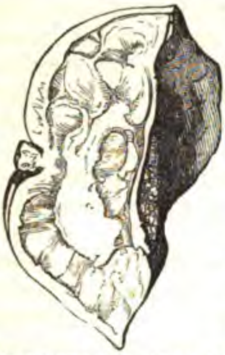
[1] With a special meaning; different from that which is attached to the same word, when used to denote malignant disease in general (p. 58).

The origin of the diseased formation is not precisely known. So soon, however, as the formation and growth of this tumor have been fairly established, there is observed to be involvement of adjoining parts; all tissues, however dissimilar, are converted into the same degenerate and evil structure. On a section being made, the tumor is of great density; in this respect almost equal to cartilage; it creaks under the knife," cutting like a raw potato or unripe pear. It is found to consist of two distinct portions; an interlacement of fibrous matter, in the interstices of which a granular substance is laid, of a gray color. The general aspect of the section is dense, fibrous, and gray.

Fig. 74.



Carcinoma of the breast, bisected. The figure of the tumor, with its effect on the gland and nipple shown.

Fig. 75.

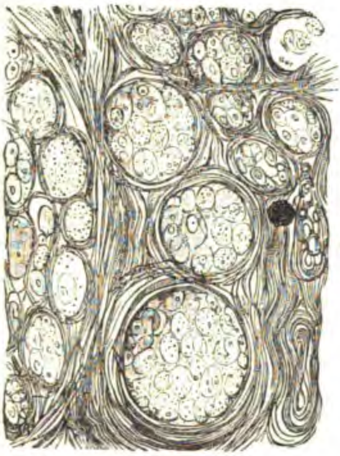
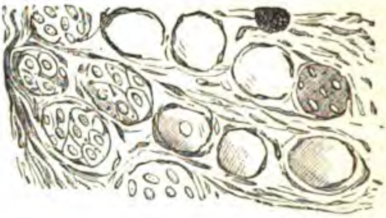


Fig. 76.



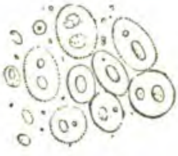


Fig. 78.

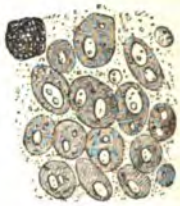


Fig. 77.

Fig. 75. Portion of the section from a carcinomatous tumor of the breast; consisting of fibrous tissue and cysts, enclosing cancer-cells and granules. A compound granular corpuscle is also visible.

Fig. 76. Another portion of the same section treated with acetic acid. The fibrous tissue is rendered more transparent, and elongated nuclei are visible scattered throughout it. The nuclei of the cancer-cells are unchanged, while their walls are very transparent. A compound granular corpuscle is seen at the upper part of the figure.

Fig. 77. Cancer-cells from the cream-like juice squeezed from the tumor. Numerous granules and a compound granular cell are seen.

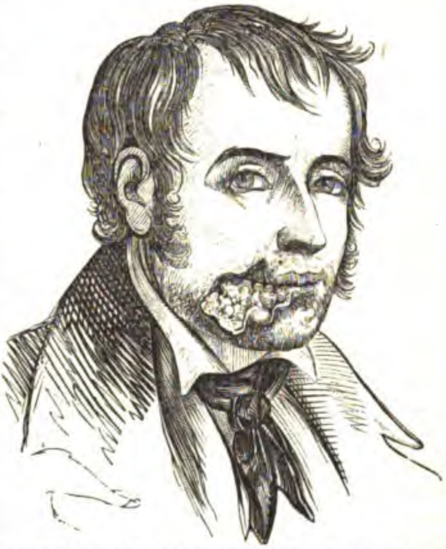
Fig. 78. The same after the addition of acetic acid.—BENNETT.

Microscopically, carcinomatous tumors show a distinct basis of fibrous tissue, in which are infiltrated multitudes of cells of the kind already described as cancer-cells. When in the young or newly-formed condition, the cell-wall is exceedingly delicate, often difficult to be seen, and always becomes so on the addition of acetic acid, by which the nucleus is made very distinct (Figs. 71, 72). There is always, moreover, more or less granular and molecular matter in the cancer-juice; and in some cases this is infiltrated into the cancer-cells to such a degree as to render them opaque or even dark, like the compound granular corpuscles of inflammation (Figs. 75, 76, 77). It is probable that this increase of granular matter is dependent on the age of the cell.

In all cancerous formations, portions may be observed which are more opaque in color than the rest. These are generally of a yellowish tint; and are found to present very imperfect and often dilapidated cancer-cells, as if the formative process had here stopped, and the disease were at this point retrograde. At the same time, there is commonly a larger quantity than usual of the granular deposit. In the mamma, a number of yellowish opaque points are sometimes seen on the surface of a section; giving, when pressed, a yellow juice, and having a somewhat reticulated arrangement. This is the *Carcinoma reticulare* of Müller, and indicates the incipient decay and fatty degeneration of the cancer-cells, which are in such parts generally found more or less broken up, and loaded with granular matter (Fig. 73).

The arrangement of the texture is most distinctly seen, after removal of the gray matter by scraping or maceration; and the microscope shows the structure to be in great part fibrous. The gray matter, microscopically, is found to consist of nucleated cells and molecules, chiefly globular, but some caudate or spindle-shaped. Whether this "materies morbi" is simply deposited from the blood, or is the result of extra-vascular formation, seems yet undetermined.

Fig. 79.



Cancer of the lip. At the upper part, the angular margins rather too formal, as if done by a knife.

When the carcinoma is original, it is seldom surrounded by any cyst; but extends itself diffusedly, as if by roots, into the surrounding texture. When it is of secondary formation, the cyst of the originally simple mass for some time remains uninvolved, but ultimately disappears in the general invasion of structure.

Cancer, properly so called, denotes the open or ulcerated condition of the carcinomatous tumor. It may also commence as an ulcer, without any previous solid growth; as happens, not unfrequently, in the mucous membrane and skin.

The tumor, having approached the surface, softens in some parts of its interior; the carcinomatous texture becoming broken down, pulpy, and often mixed with blood. This process of softening and disintegration—the result, possibly, of an inflammatory process kindled in the morbid structure—spreads outwards; and, by its agency, an integumental breach is in due time effected. There is no sprouting fungus, as in the medullary tumor; for the morbid structure is devoid of elasticity, as well as less rapid in its production. The breach widens and deepens; the carcinomatous texture, where exposed, continues to crumble down; and the reparative efforts which are occasionally made show only a few, straggling, hard granulations, which quickly fall away under reaccession of the ulceration. While, howev [illegible] ive efforts are few, and wholly ineffectual, reproduction, a [illegible] the diseased structure, is constant and efficient. Portions of [illegible] sometimes come away, not in particles, but in masses; but gen [illegible] is little or no diminution of the tumor, or abatement of the disease, in consequence; the place is soon occupied by fresh formation, and the onward progress is unchecked. Sometimes, however, the ulceration advances rapidly, without reproduction; forming a deep and cavernous excavation.

The characters of the cancerous ulcer are very peculiar; and, once seen, can scarcely again be mistaken (p. 234). The edges are hard, serrated, and everted; the eversion complete; the hardness, as that of cartilage. Sometimes the margin is white, like cartilage; sometimes it is of a red angry hue. The surface discloses the morbid structure, soft, and in process of ulceration; studded, at some points, more especially near the margin, with the futile granulations already spoken of. The discharge is thin, bloody, and profuse; possessed of an intensely fetid odor, so peculiar as generally to be held of a pathognomonic character. Pain is burning and constant. There is no power of cleaning this sore; under every application, it looks foul and loathsome. Sometimes it is covered by a black and tawny slough. Not unfrequently, a dark, bloody oozing takes place, from some part of the ulcer, perhaps on separation of such a slough; sometimes there is smart hemorrhage.

One peculiarity of carcinoma and cancer is, that the disease is especially prone to extend by the lymphatics. Sharp, stinging pains are felt, in the direction of the main lymphatics and their ganglia; shadows of the coming event. Then hard and tender cords are observed, extending from the tumor on the lymphatic aspect; sometimes with small indurations by their side. These cords may stretch, unbroken, to the ganglia—as in the axilla; and there a second tumor, in all respects like to the first, only of more rapid growth, and more distressful in its symptoms, begins to form. Or this may take place with few or none of these premonitory symptoms; without cord or kernel in the intervening space. The œdema which now occurs in the limb, whose lymphatics have become thus obstructed, is great; the pain is constant, severe, and sometimes excruciating. So much so, that often the patient's attention is entirely diverted from the original malady, and fixed on the part which has become so swollen and painful. The cachectic state of system becomes more and more aggravated; sleep is gone; appetite fails; emaciation is great, and still increasing; the sallow, wan, cadaverous expression of face becomes more marked; the whole frame grows bloodless; a malignant hectic, as it may be termed, is established; and life is gradually exhausted, in much physical misery. Sometimes the fatal issue is accelerated by the accession of an internal disorder, structurally unconnected with the cancer. In cancer of the mamma, for example, pleurisy with effusion often constitutes the immediate cause of death.

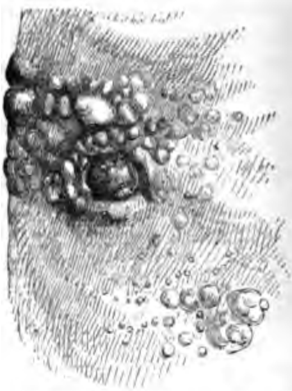
The period of lymphatic invasion varies. Sometimes, at a very early stage of the primary tumor, the secondary formation is begun. In other cases, months, and almost years may have elapsed, without as yet any affection of the lymphatics being apparent; but this is as the exception to the general rule. It is seldom that the stage of cancer has been of long duration, without secondary formation having been at least apparent; the ganglia, which seemed to remain sound during the occult stage, generally soon give way when the open condition has been established. Sometimes, the secondary lymphatic tumor is not carcinomatous, but medullary.

During the cancerous progress, a peculiar fragility of the skeleton is liable to occur; untowardly complicating the case. On some slight exertion, as turning in bed, walking across the room, or rising up suddenly; or in consequence of some slight injury, by blow or fall—a bone breaks. The patient becomes bedridden in consequence; by confinement the cachexy is increased; and the fatal issue is accelerated. Sometimes the bone unites in the ordinary way, by callus, under the ordinary treatment; and the patient temporarily recovers from the complication. Sometimes, there is no union at all. Perhaps, more frequently, there is a reproductive effort, but not of callus; a depraved deposit takes place; and, at the site of the fracture, a new carcinoma is soon in progress.

By most authorities it is agreed, that the carcinomatous disease—or diathesis, as it may well be termed—is hereditary; the peculiarity of constitution leading to this disorder being sometimes transmitted from parent to child. It has been supposed contagious; but the evidence on this subject is very unsatisfactory. The predisposing cause of the malady is, doubtless, a constitutional vice, which has not yet been satisfactorily explained in its origin, but which is most obviously present in all advanced cases, and has been termed the carcinomatous diathesis. The exciting cause may be injury, or stimulation of a part, in a system so contaminated; and with, or without, the previous existence of simple tumor. The scrotum, habitually irritated by soot and filth, becomes the seat of carcinomatous structure, and cancerous ulceration; a prolabium, in advanced years, repeatedly injured, undergoes a similar change. On the other hand, a tumor, originally simple, degenerates in consequence of frequent or habitual injury, applied in the vain endeavor to obtain discussion; and, in its degeneration, it may assume the structure of carcinoma. And as a simple tumor may thus change into a malignant—so an ulcer, as in the prolabium, originally simple, and disposed to heal kindly and permanently, may, from repeated irritation, degenerate into cancer.

Treatment.—It is hopeless, and worse than useless, to attempt discus-

Fig. 80.



Carcinoma; secondary. An example of the numerous nodulated tumors, which often form in the cicatrix of the former growth. One is ulcerated in the site of the mammilla.

sion of the carcinoma. The tumor will only have its energies further roused, and proceed more rapidly to its fatal issue. Besides, valuable time will have been sadly misspent, and opportunity lost of affording the most favorable chance of cure—by timely extirpation. Leeching, rest, and fomentation, may palliate the symptoms, and retard the growth; yet they do nothing towards actual cure; and are reprehensible as consumers of valuable time. But, as formerly stated (p. 267), much benefit occasion [illegible] n discussion of the commo [illegible] ie sub-inflammatory pro- cc [illegible] ave taken place around, ar [illegible] of the apparent bulk of the tumor may depend. Let this attempt, however, be cautiously conducted; so as to stimulate absorption, and nothing more. For should vascular excitement ensue, with increase of deposit, whether in or out of the tumor, nothing but harm can follow. If it be true that the elementary cells of such growths are capable of being infiltrated into surrounding textures, during excitement in or around the tumor, it becomes very plain how perilous must be the induction of such excitement by stimulation, in any way, or with whatever object in view; the cells are lodged, perhaps in numbers, at a distance from the main tumor; and, on the removal of that, even by wide incision, sundry others quickly form to take its place. This theory would seem to be favored by the fact, that after removal of carcinoma by operation, especially from the breast, the usual mode of return, at the original site, is not by the formation of a large tumor as before; but by the appearance of numerous, small, stony, and painful kernels, so superficial as to seem to be integumentary; after a time uniting to form a confluent mass, which ulcerates and otherwise advances untowardly, as carcinoma usually does.

Of late, attempts have been made to effect a cure by means of compression, steadily and uniformly applied. Arnott's apparatus accomplishes the maintenance of such a pressure very admirably, and as already stated, may diminish bulk by absorption of the ordinary inflammatory products. It may also retard the growth of the tumor itself; but in few cases, if any, may actual cure be looked for. If employed so as to excite vascular action in the part, harm must ensue, as above shown.

Rubbing the part may diminish bulk in the same way as pressure; but, in other respects, is obviously not so safe an application. That a cancerous or other malignant growth should be dispelled and cured by systematic rubbing, is of course altogether visionary—or worse.

Congelation of the affected part has been employed, at the instance of Dr. Arnott, by means of pounded ice and salt; with the effect of sometimes alleviating the symptoms, if not arresting the growth of the disease.[1]

Is there a specific for any disease? is a question which can hardly be answered in the affirmative. Is there a specific for carcinoma or cancer? is a question which we need not hesitate to answer with a decided negative. Many have been declared, and many have been tried as such; yet all with but one issue—failure. Some, comparatively harmless, failing in the main object, yet may have palliated suffering, and even somewhat delayed advancement. But the majority, of a stimulant nature, favored the tumor's increase, bore further down the system, and rendered death both more early and more wretched.

The only chance of cure is by direct, early, and thorough removal of the morbid structure; and this may be effected by cautery, or by incision. The actual cautery has been employed with this view; but is now in most cases laid aside. Potential cauteries—potassa fusa, mineral acids, chloride of zinc, arsenic—have held their place longer, and with a better prospect of continuance of tenure; but yet must give way, on the score of efficiency, to the knife. Their present place, in good surgery, is not among the main agents of removal, but only as auxiliaries. When the knife has taken away as much as it can, and a suspected portion yet remains, inaccessible to its edge, the cautery is then most useful. Also, in cases of cancerous ulcer, or ulcer of a suspicious kind, very superficial, and of no great extent—as on the prolabium, or on a portion of integument—the potential cautery may itself suffice, when freely applied.

Excision is infinitely the preferable mode of removal, in the majority of cases; by a free, cautious, and wide dissection. Care being taken, that not only the whole of the morbid structure is taken away, but also that a border of apparently sound texture goes with it; in order, if possible, to make sure that none of the cellular or other germs of the disease are left behind, in the interstices of the adjoining textures. In regard to such dissection, it is useful to remember, that dense fibrous tissue resists the invasion of carcinoma longer than any other texture; and that, consequently, the incisions need be less free, beyond that tissue, even where it is partially incorporated with the tumor. But yet, in all cases, the propriety is obvious of approaching error on the safer side; rather sacrificing texture unnecessarily, than encountering the risk of leaving a nucleus of reproduction behind.

Some, taking an abstract view of the subject, entertain a question as to the expediency of operating at all in carcinoma; inclining to regard the affection as wholly constitutional, and not to be eradicated, or even restrained, by removal of only a local portion of it. This view we do not propose to consider; but, with the majority of the profession, granting that the disease is constitutional as well as local, and that in most cases it shows more of the former than of the latter character; granting that very many cases occur—doubtless the majority—in which operation is inexpedient; and granting that in all cases, looking to the constitutional vice, we can never be certain of immunity from return, and must invariably issue a guarded prognosis accordingly:—still we are of opinion, that there are cases, often presenting themselves to the surgeon in extensive practice, in which it is his bounden duty, by operation, to afford his patient the chance either of a definite and radical cure, or at least of a postponement and palliation of the malady. Such cases are those in which the tumor is yet small, and comparatively circumscribed; the lymphatics unchanged, either in the immediate vicinity or at a distance; the integuments and muscles free from incorporation; the patient not far advanced in years; and the cachexy as yet but little indicated, if at all. On the other hand, affection of the lymphatics, already begun, even though to a trifling extent, contra-indicates operation; for, according to experience, reproduction is sure to follow, even when the surgeon is certain that not only the tumor itself, but the adjoining changed structure as well, lymphatic or not thoroughly taken away. Incorporated skin and muscle can b by wide and free incision; yet, in such cases, it is often diffic possible, to say that what is left is sound, free from lodgmen teries morbi already in its texture; and, in these circumstances, experience again speaks loudly in favor of relapse. In the very old, a carcinoma may exist for years, in a latent or indolent condition; still occult, and still of small size and circumscribed; the seat of little uneasiness, and attended with but little disorder of the system; indeed the patient may die, ultimately, of disease to all appearance totally unconnected with the carcinoma. Under such circumstances, operation is withheld; the tumor is left undisturbed, and guarded carefully from excitement. But while thus, in the patient of seventy, the progress of the tumor is slow, and the indications of cachexy weak or apparently absent—the opposite obtains in regard to the patient of forty. And when, at such age, a tumor is advancing rapidly, with a marked cachexy at the same time consuming the general frame, it is prudent to abstain from the knife, even though the lymphatic system seem as yet wholly uninvolved; for, in such cases, the probability of return is extremely great; the disease being not delayed by the operation, but truly undergoing exacerbation. And thus we see, that extreme activity of the disease in the comparatively young, and extreme indolence of it in the aged, both alike contra-indicate operation. It may also be observed, that, *cæteris paribus*, return is more probable in the case of the open tumor, than of the occult.

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[1] Lancet, Nos. 1409 and 1411, pp. 259 and 318.

In those cases in which there is freeness of integument, and laxity of all the surrounding textures, it is well to conduct the incisions and subsequent treatment, so as to favor adhesion of the wound, and mobility of the cicatrix; for experience has declared such a state of matters favorable to immunity from return; while tedious suppuration and granulation, resulting in a tight, firm, adherent cicatrix, strained by each movement of the part, have an opposite tendency. All irritation of the cicatrix, of whatever kind, should of course be carefully avoided.

An important question arises, whether, after thorough removal of the apparent local disease, by operation, we have any means of staying, or altogether removing, the constitutional vice; and so securing a permanent cure, by immunity from return. It is to be feared that such a question can as yet only be answered in the negative. The conium has long enjoyed a certain reputation as possessed of such a virtue; and by some surgeons, it is trusted in, and administered accordingly. A tonic system of general treatment—preceded, if need be, by alteratives—is indicated, to assist in prevention or arrest of the cachexy's development; and the preparations of iron are usually found suitable. Arsenic, too, may be of service, in this way; though not as a specific.

When return has occurred, under what were supposed favorable circumstances, there may come to be a question as to the expediency of further operation. If the return be in the usual manner, with ulceration and tumor of the cicatrix, numerous superficial nodules around, and obvious involvement of the lymphatics, no good can result from further interference by the knife. But if the return be by an occult, small, and limited tumor, as sometimes happens, and if the general system be yet comparatively sound—then by a second, and if possible still more careful and complete operation, the remaining chance, slight though it must be regarded, ought certainly to be afforded—especially if requested by the patient.

In the truly hopeless cases, we content ourselves with palliation. A rigidly spare regimen will be found to do no good by delaying the tumor's growth, while it does much harm by favoring the cachexy's inroad on the general frame; the diet should be simple and non-stimulant, yet nutritive, and rather full than otherwise. By opium and other anodynes, exhibited internally, sleep is procured, and pain of the part and neighborhood allayed. No stimulants are applied to the tumor; on the contrary, all such are carefully avoided; it is our object locally to soothe; and, for this purpose, opium, belladonna, conium, may be employed in the form of epithem. In the ulcerated state, much relief is often experienced from the frequent, or even constant, use of a plain and light hemlock poultice. Fetor is corrected by the occasional application of solutions of the chlorides, and by strict attention to cleanliness. The part and its vicinity should be kept as much as possible in a state of rest. Local warmth, by some soft article of clothing, as wool or fur, is also expedient. All friction, with or without stimulant embrocations, is in the highest degree pernicious. Were the disease merely local, pressure might perhaps be cautiously conducted, so as to arrest development of the part, or even to obtain a partial decrease; but, as it is, carcinomatous formation and increase elsewhere, probably in an internal organ, would in all likelihood be the result of temporary obstruction at the original site of development. And besides, ulceration, by over-excitement, is the usual local effect of pressure on such tumors, even when most carefully employed (p. 286).

Operation, even in the most hopeless cases, may sometimes be deemed expedient, as a mere palliative. When there is a large and ghastly sore —as of the mamma—pouring out much fetid ichorous discharge, and the seat of constant agonizing pain, conversion of the fetid and painful ulcer into a comparatively simple wound may, for a time, afford very marked relief. The ulcerated part is taken away by rapid dissection; the bleeding points are secured; the wound is left to suppurate, under simple water-dressing; no stimuli are applied; it is seldom that coaptation by suture is practicable, and under the circumstances it is scarcely expedient; the wound contracts, and may even heal for a time. Degeneration ultimately returns, and its advance is again rapid and untoward;

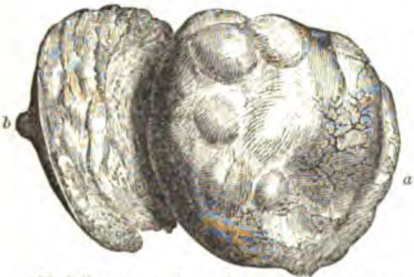
but, during the interval, the patient may have been privileged to enjoy much comparative ease and comfort. In those cases, however—and they are the majority—in which the exhausting shock of an operation, acting on the system, will more than overbalance the contemplated benefit to the part, operation is altogether to be abstained from.

10. THE MEDULLARY TUMOR.—The Encephaloid, or Cerebriform Tumor, the Medullary Sarcoma, the Cephaloma. There are other synonymes, but these are the most frequently employed; terms originating in the likeness which the morbid product bears to brain, in color, texture, and consistence; and yet the resemblance is far from being so close as to warrant the appellative of an analogous formation. The tumor may be from the first of this kind; or a growth, originally simple, may have degenerated, and assumed the medullary character. And it is to be remembered, that when any tumor does degenerate into malignancy, it is generally the medullary structure and character which it assumes.

This tumor is highly vascular; supplied and intersected by large veins; and also not without its arterial nourishment. The simple tumors are all sparingly vascular; the simple sarcoma is moderately supplied with bloodvessels, the adipose is less so, and the fibrous less still; the tubercular deposit is in itself non-vascular, and the areolar stroma with which it may be connected is not likely to be increased in its vascularity. In this respect, the malignant formations differ prominently from the benign; they are all freely supplied with bloodvessels; and the medullary particularly so. Indeed, in regard to tumors in general, there is good reason to believe, that the less the vascularity, not only the less rapid is the growth, but the less the tendency to degenerate.

Section of a medullary mass displays a consistence, color, and general aspect of structure, somewhat like that of brain; its vascularity is shown by the open mouths of large veins, and other arborescent vessels. The arrangement of the morbid mass is generally even and smooth. Microscopically, the tumor is found to consist of cells similar to those of the hard cancer; but usually accompanied by much more fluid, and less fibrous tissue; and hence the soft and yielding character of the growth. The cells may have every grade of development, from the earliest and youngest, to the retrograde condition. Sometimes it is surrounded by a cyst; if so, the cyst is usually imperfect, at one or more points, and there the tumor has plainly increased more rapidly than elsewhere. More frequently there is no envelope; the surrounding textures having not been pushed aside, but drawn into the structural change. It is not unusual to find one or more dense fibrous bands intersecting the mass; but these are not to be regarded as a part of the original tumor; they are accidental, and owe their existence to the approach and union of two or more medullary masses, between which a

Fig. 81.

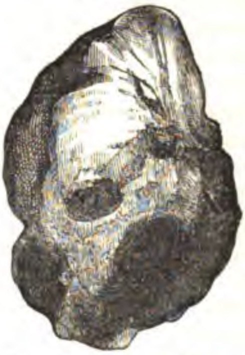


Medullary tumor beneath the mamma; *a*, the tumor; *b*, the mamma.

part of the original textures, much condensed, still remains free from the medullary change. At first the mass is homogeneous. But after a time softening occurs, at one or more points, by imperfect suppuration; and there the consistence and color resemble somewhat those of cream; not unfrequently, however, of a much darker hue, by admixture of blood. Blood also is often found in masses, not fluid, but coagulated; sometimes it is infiltrated diffusely throughout the morbid structure; signs always of evil omen, indicative of much malignancy, and an almost certain return.

In tumors of any considerable duration, cavities may always be expected, more or less numerous. They are of two kinds; mere spaces, formed by softening of the medullary substance, and occupied by this softened matter variously mixed with blood, solid or liquid; or true cysts, lined by a secreting membrane, and filled with frothy blood, with dark fluid, or with soft medullary matter. When the latter are found, the probability is that the tumor has been originally of the simply cystic kind; that it has degenerated; and that these cysts are remains of the original and non-malignant structure, not yet annihilated. In other words, it is believed that cysts lined by a secreting membrane do not enter into the original structure of medullary tumor. All the simple tumors are liable to degenerate into the medullary; the cystic the most prone; the fibrous the least. And when a section is made during the period of transition, part of the original structure is found, gradually and insensibly passing into that which has already assumed the medullary characters.

Fig. 82.



Encephaloid tumor; of especially evil mien; at the lower part, bloody extravasation extensive.

So long as the tumor is invested by the integument, entire, it is said to be occult; when the skin has given way, and the morbid structure consequently comes to be exposed, it is said to be in the open state. This opening is effected by inflammation and ulceration of the skin, or other intervening texture, at the most prominent point of the swelling. In consequence of the elasticity of the morbid structure, a projection of the mass immediately takes place; and this is increased by rapid growth at this point, where resistance has been removed. A fungus is speedily established; much of the same texture as the general tumor; but softer, and darker in color, in consequence of atmospheric influence and admixture with extravasated blood. The surrounding integuments are without reparative effort; ulceration extends in them; and a fetid, bloody, thin fluid is profusely discharged. Sometimes the fungus sloughs, or crumbles away by softening and disintegration; it is, however, quickly reproduced. Not unfrequently, a bloodvessel, probably one of the large veins, is opened into; and profuse hemorrhage results, of a dark unwholesome kind; fearfully aggravating the prostration of system, which the previous state of the tumor had already begun. Occasionally the part surrounding the fungus assumes, for a time, many of the characters of the healthy, healing sore.

In the open state, the nature of the formation is sufficiently plain; in the occult, diagnosis is not always readily effected. It is important, therefore, to be aware of the external characters, and other signs of the existence of the tumor, from even its earliest formation. Its growth is peculiar; being the most rapid of all tumors; in a few months, or even weeks, the size may have become truly enormous; and very frequently a marked increase, day by day, may be readily observed. A fallacy, however, may occur as to this point. A simple sarcoma, deeply seated, and tightly bound by fibrous investment, may simulate some of the characters of the occult medullary tumor very closely; the surgeon, in doubt, manipulates it freely, and, for some time, perhaps daily; he thinks he observes a marked and rapid i[illegible]ze, and by measurement or otherwise he may ascerta[illegible]tually the case. This last sign he may think conclu[illegible], [illegible]llary nature of the tumor; and he may take his meas[illegible]s [illegible]ccording to that conviction. And yet had he waited for a few days more, abstaining the meanwhile from further handling of the part, he would have found a subsidence of the increase in bulk, the tumor regaining its former dimensions. The temporary enlargement had resulted from the common products of simple vascular excitement, the consequence of manipulation.

The skin investing the tumor is pale, like that of a diseased and chronic articulation; and usually shows many large veins coursing beneath it. Sometimes the skin is of a brownish hue. At first, it is movable on the tumor; afterwards intimately incorporated therewith. The growth itself is not circumscribed and movable, as the simple formations, but fixed and diffused into the surrounding parts. To the touch a sense of great elasticity is imparted; different from the fluctuation of chronic abscess, and different also from the semi-fluctuation which the fatty tumor exhibits, yet somewhat resembling both; insomuch that it is not without the tactus eruditus—as well as attention to other signs—that the distinction can always be unerringly made. Occasionally, even the most experienced cannot be assured, until after an exploratory puncture. Perhaps they expected pus; but nothing save blood escapes, and that profusely; vascularity and elasticity are demonstrated, not fluctuation. Pain is almost always considerable; often severe and shooting. In some cases, it is at first absent; and then the tumor is usually slow of growth; but when it enlarges in the ordinary manner, as it soon does, the pain becomes developed, and continues. The patient is obviously cachectic; and bears in his countenance a plain token of a formidable disease; the features are shrunk and anxious, the hue is sallow, emaciation is begun, the functions of animal life are all disturbed, and hectic is setting in. While carcinoma and cancer are comparatively limited to advanced years, this disease is found to occur more frequently in the young; children and adolescents are the ordinary patients. It may occur in any texture; but is most frequent in the orbit, testicle, mamma, joints, internal viscera, and lymphatic ganglia. In the two last situations, the formation is usually of a secondary character; that is, following on the appearance, or perhaps the removal by operation, of a malignant tumor elsewhere. For, as already observed, the disease extends not only by contiguity, involving the adjacent tissues, but also remotely by the lymphatics; and besides, the system being involved—probably as the original part of the malady—there is the same predisposition to the morbid deposit in one part as in another. Sometimes the veins in the neighborhood have been found filled with the medullary substance; but whether by simple extension of the tumor, or by conveyance of the deposit, is a matter of doubt. Pressure on veins and lymphatics occasions œdema of the parts beneath; compression of adjoining nerves creates intense pain, in addition to that which already existed as an inherent characteristic of the tumor. At first, the nervous trunks are expanded and stretched over the growth; ultimately they are involved in its structure. Occasionally, the disease has been found to extend by means of a nervous trunk; a tumor growing thereon, at some distance from the original formation, and precisely of the same character; a medullary tumor involving the sciatic nerve, for example, has been followed by a growth of the same kind occurring in the popliteal.

It is plain that the only chance of cure is by extirpation, at a comparative early period; when the tumor is small, not deeply or widely connected, the glands free, and the system making but little show of complaint. The dissection must be carefully and leisurely conducted, to insure entire removal of the whole diseased structure; as the slightest portion left will certainly cause reproduction, rapidly, and of a worse tumor than the first. Smart hemorrhage is to be expected; not only from arterial branches, increased in size and activity, but also by oozing from the general surface. The muscles are usually of a pale and flabby character; sometimes at certain points, near the tumor, they are the seat of dark discoloration, as if by infiltration of blood. There is also a greater tendency to secondary hemorrhage, than after simple wounds.

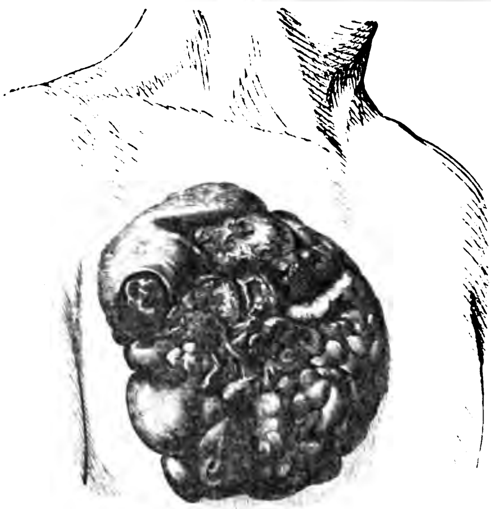
The operation having been suitably performed, the question of prognosis arises, as regards the probability of return; a question always of much doubt and difficulty; and never to be answered decidedly in the affirmative. Such a tumor, like the tubercular, is in the great majority of cases to be viewed not so much as a disease in itself, as a symptom of a constitutional vice, from which other tumors may arise of a similar nature, in the vicinity of the first formed, or elsewhere. In both cases there is a cachexy, constituting the major part of the evil; that of tubercle is but little amenable to treatment; the malignant and medullary is still less so. And unless that cachexy be removed—an object in this disease unattainable—there can be no certain immunity from return. Our duty is very plain: to operate, carefully, in those cases of recent and limited tumor, the circumstances of which seem favorable to success; to refrain from operation in those advanced cases, where not only deep and important parts are involved, but where both the lymphatic and general systems are plainly implicated, and where consequently reproduction is certain; and in all cases to express our prognosis in the most guarded terms. According to my experience, the situations most favorable to non-return, after timeous operation, are the eye and testicle; especially the latter.

Reproduction occurs either in the original site or elsewhere. A medullary tumor having been removed from a lower limb, for example, we apprehend return not in the stump alone, nor in the groin, nor in any part of the external surface; but are anxious in regard to symptoms of internal mischief, by formation of medullary masses in the liver, kidneys, or lungs. The internal reproduction is perhaps the most common; not unfrequently, the return is on the surface as well. As already stated, bloody masses and infiltrations, shown in a section of the original tumor, are declared by experience to be ominous of return. And under whatever circumstances the return does take place in the original site, the secondary formation almost invariably shows an aggravation of progress and malignancy; probably in consequence of increase of the cachexy, which the untoward effect of the previous operation has induced.

Molluscous tumors of and be[illegible]in, occurring in great numbers over the general su[illegible]uently present all the characters of the medullary f[illegible]ases are obviously hopeless. Operation is unwarrantable, a[illegible] content ourselves with palliation.

11. FUNGUS HÆMATODES.—This condition occasionally arises out of the medullary tumor, when in the open and ulcerating condition. It has already been stated (p. 290) that protrusion of the medullary mass, and infiltration of it with extravasated blood, are liable to occur under such circumstances. But in order to constitute a true Fungus Hæmatodes, three things are essential: that there shall be a fungous projection of morbid structure; that the fungus be dark and bloodlike; and that it bleed, more or less profusely. This condition may be either of a primary or of a secondary character; much more frequently it is the latter. Examples have occurred in which, without other morbid formation, a small, dark fungus has shown itself, bleeding profusely from time to time, perilling life, and demanding the most urgent measures for its removal. But, more frequently, there is first a tumor of malignant character, which opens, and ultimately throws out the bleeding fungus; and the fungus hæmatodes, in this, the most frequent case, is to be regarded as the climax of malignancy in a formation already of evil nature. The morbid structure, on which it most frequently supervenes, is the medullary. The untoward symptoms are all much aggravated by the accession; the cachexy becomes more marked; the frame sinks lower and more ra-

Fig. 83.



Fungus hæmatodes. Fungoid, bleeding, and bloodlike. From the mamma.

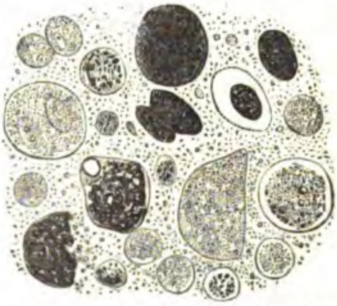
pidly; the malignant hectic has an acute exacerbation; pain and misery are great; exhaustion is rapid; and fatal sinking is not long deferred.

In tumors, there may be two steps of degeneracy: from the simple structure to the medullary; from the latter, to the condition of fungus hæmatodes. But, usually, the medullary formation, from which the bleeding fungus springs, is of primary origin. All medullary tumors, when open, tend to fungate; but all medullary fungi are not entitled to the appellation of fungi hæmatodes. It is easy to understand, however, how the hæmatoid condition should not unfrequently occur; by softening and breaking down of the medullary texture, whereby one or more of the large vessels found permeating such growths are opened into. A detached portion of the medullary mass, or a fresh protrusion, may temporarily occlude the aperture; but, in its turn, it crumbles away, and the bleeding recurs. The part is obviously incapable of adopting the ordinary natural hemostatics.

This is the most malignant of all morbid structures, and little amenable to treatment. There is no hope but from early removal by the knife; and, in most cases, amputation of the member is preferable to excision of the part. But do what we will—however early, however summarily—too generally the disease returns, and the patient falls its victim. And when we consider that the greater number of cases are merely the advanced stage of medullary tumor, we can readily understand how the experienced and judicious surgeon, encountering an example of fungus hæmatodes, often finds himself constrained to non-interference, and has to content himself with palliating what he cannot cure.

12. THE MELANOTIC TUMOR.—The deposition of pigmentary matter of black or brownish color, in various organs or tissues, is not necessarily connected with malignant disease. A common form in which it occurs, is in the lungs; where it constitutes a species of spurious melanosis, dependent on the infiltration of carbon into the tissue. With this we have nothing to do. The pigment which enters into the formation of tumors is of a different character; it is in some way formed from the blood, like that of the choroid coat of the eye, and, unlike the carbonaceous pigment, is readily decomposed by nitric acid, with the aid of heat. It forms brownish or black granules under the microscope, tending to the angular form, and of very various size—from the minutest molecule to the size of a blood-corpuscle. When this pigmentary matter occurs in a distinct tumor, and is infiltrated into its cells, we have the disease at present under consideration; which must not be confounded with those dark-colored deposits which take place in many textures, without tumor, and without any other alteration of nutrition.

Fig. 84.



Cells more or less loaded with black pigment, from a melanotic tumor of the cheek. —BENNETT.

This disease occurs much more rarely in man than in the lower animals—particularly the horse. It is to be observed, however, that in animals the malignant character of the affection is not so well marked as in man. Like other tumors, it is the result of perverted nutrition; a thorough change of structure. It occurs in areolar tissue; more especially in that connected with the serous membranes. Sometimes it is pure; more frequently it is complicated; and the morbid structure with which it is most frequently associated is the medullary. The external surface is of a shining and mottled appearance; the form is more or less globular, and lobulated; the size is seldom great, rarely indeed exceeding that of an egg, in the human subject; inconvenience is slight, and scarcely amounts to pain. The dark coloring matter is itself nonvascular. The stroma, in which it is imbedded, is fully vascularized; at first, it may consist of mere fibrous texture; subsequently, and soon, it becomes a new structure, of evil tendency. The most frequent site is in the globe of the eye; usually connected with medullary formation; and perhaps the frequency of this site may be connected with the normal pigment of the choroid coat.

The melanotic growth, when situated externally, follows the ordinary course of the "tumor mali moris;" involves the skin, ulcerates, and discharges black matter, with a fetid sanious secretion. And by this time, usually, the medullary structure has also been developed; giving to the sore more or less of a fungating character; involving the system in the wonted cachexy; and dragging the surrounding parts into rapid assimilation of structure. The melanosis, though doubtless in itself neither simple in structure nor benign in tendency, yet is to be regarded as malignant chiefly on account of that tendency to associate with a more sinister formation, which it so strongly and almost invariably manifests. It seldom occurs but in those of mature age; therein differing markedly from the simple cephaloma. A constitutional vice, doubtless, accompanies; but not so intense in itself, nor so obvious in its indications, as in the other malignant tumors; unless with one or other of these the melanosis be primarily combined.

There is no hope of cure, but from free extirpation by the knife; and that at an early period, ere the medullary complication have begun to form. Return, under such favorable circumstances, is less likely than in any other malignant disease. When complication has occurred, with either the carcinomatous or the medullary formation, the minor is to be regarded as merged in the greater evil; and the rules of treatment are to be enforced, as if the case were one of carcinoma, or of medullary tumor, alone.

13. COLLOID OR AREOLAR CANCER.—This is a disease more important to the physician than to the surgeon; but as it sometimes occurs in the bones, mamma, and other external organs, it will be proper to give some account of it.

In colloid cancer (*κόλλη*, glue), which in all other respects follows the ordinary laws of malignant formations, the meshes of the tumor are filled up, not by cancerous juice, but by a matter like gelatine or half dissolved gum-arabic; containing numerous microscopic cells, which present the usual characters of malignancy. Sometimes the colloid matter occurs in large masses, with very little intervening fibrous tissue; sometimes, too, the cells are in small amount. Occasionally it occurs in cysts; and in this case is very doubtfully, if at all, cancerous. When, on the other hand, it forms, as in the mamma and sometimes in the liver, in a tissue having every other characteristic of cancer, there can be no doubt as to its true nature.

Fig. 85. Fig. 86. Fig. 88.

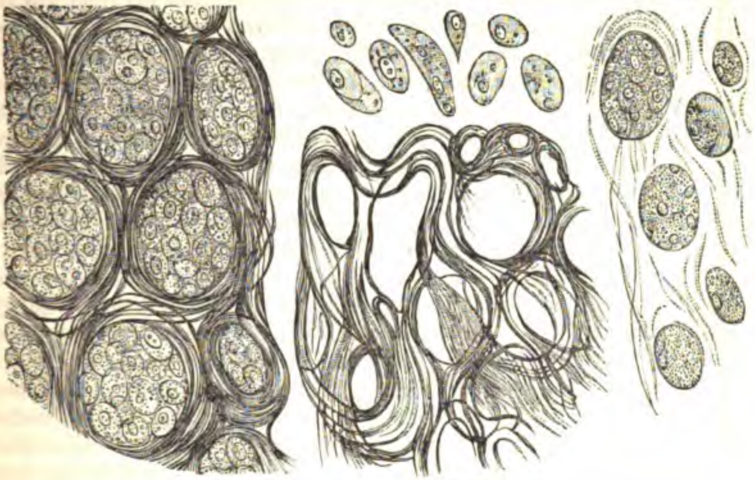


Fig. 87.

Fig. 85. Section of colloid cancer from the stomach, showing the loculi in the fibrous structure and the contained cells. Fig. 86. Several cells isolated. Fig. 87. Fibrous stroma deprived of the cells by pressure and washing. Fig. 88. Section of the growth treated with acetic acid.—BENNETT.

The surgical management of colloid cancer has nothing peculiar; being guided by the same principles as in any other malignant growth.[1]

Such are the solid tumors; simple and malignant. It may be here not inopportune to make some general observations on their removal by the knife.

Sometimes, even the most experienced are in doubt as to the exact nature of a swelling; whether it is a solid tumor, tense, and very elastic; or a cystic formation, partly solid and partly fluid; or a mere accumulation of purulent or puriform matter. It were a great mistake to plan and commence extensive incisions for what required only a trifling puncture. And in order to guard against such an accident, the thrust of an exploratory trocar or needle is expedient; an ordinary trocar, of small size; or a rather large needle, grooved on one side, so as to permit free lateral escape of fluid.

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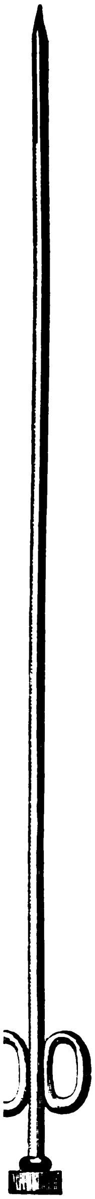
[1] In these remarks upon the different varieties of tumors, we have not thought it necessary to enter into great pathological and histological detail. The study of the minute anatomical characters of tumors has, of late years, received great accessions from the labors of Lebert, Sédillot, Kuss, Bruch, Bennett, Virchow, Paget, and others. But, on most points of practical importance, in these researches, the evidence before us is of too conflicting a character to be made available in a work like the present. We have endeavored to state, within moderate compass, those results which we consider to be most worthy of notice, and refer the student for further information to the bibliography in p. 304.

Fig. 89.



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But such exploration is by no means so light a matter as some would seem to consider it. It is not warrantable to plunge a trocar into any and every tumor, of whose nature there may be some doubt. If it be an abscess, no harm ensues; the puncture is immediately enlarged, for the purpose of due evacuation. If it prove to be a solid growth, there may still be no harm; provided patient and surgeon are prepared at once, or at all events within a day or two, to proceed to extirpation. But much injury will not fail to result, if, after puncture, the tumor be left to itself for some considerable time; and more especially, if absurd attempts be made, by stimulatio[illegible] by absorption. There is no more sure [illegible]mor's degeneration than the thrust of [illegible]ar. On a section being made of the [illegible]removal, the origin of the doubly depraved [illegible] unfrequently be seen in the instrument's track. While, therefore, exploration is expedient, to guard against error of diagnosis which otherwise might occur, and which might lead to serious error in practice—its use ought to be limited to very doubtful cases, in which other means of diagnosis, patiently and skilfully used, have failed to satisfy; and not even in such cases should it be had recourse to, unless early operation, if not immediate, have been determined on, in the event of the swelling being proved to be an undoubted and undiscussible tumor.

As a general rule, the line of incision should be parallel to that of the subjacent muscular fibre; for then the wound will be more easy of coaptation, and consequently more capable of adhesion. But to this there are exceptions. When important bloodvessels or nerves are concerned, we cut in the line of their course; and so encounter less risk of injuring them. In the forehead and face, we often cut nearly transversely to the line of muscular fibre; finding it to be of more importance, as regards both subsequent deformity and immediate coaptation, to be in the line of habitual integumental folds—the result of muscular action. It will be afterwards seen that, in the case of deep exostosis, it is also expedient to place the wound not altogether in a line with muscular fibre.

The external incisions should be always free; rather too extensive than otherwise. For thus both facility and safety of dissection will be materially favored. Besides, an excavation, with but a narrow integumental orifice, is much more likely to prove troublesome by suppuration, than a more extensive yet simple wound, whose largest dimension is superficial.

Integumental incisions are much facilitated, by previous tension of the skin. But, when certain lines or points are important guides to the relative anatomy of subjacent parts, care must be taken, while stretching, not to displace them.

The incisions should commence where the principal bloodvessels and nerves enter; advancing steadily from that point. The nerves are cut at once, and thus the subsequent dissection becomes comparatively painless; even independently of chloroform. The arterial trunks, too, being cut early, and compressed as soon as cut, the operation in consequence is comparatively bloodless. Following an opposite course, an unnecessary amount of blood is lost, the number of ligatures is great, and protraction of pain is unwarrantably inflicted.

Also, unless hemorrhage be very alarming, or the patient be already so sunk by disease as to be incapable of bearing loss of blood, deligation of the cut vessels should be reserved till after the tumor's removal; temporary arrest being intrusted to the fingers of an assistant. Thus, time is saved in the most painful part of the procedure. And the number of ligatures will also be diminished; it being likely that some of the smaller branches—important enough to have demanded deligation, at the time of their section—will be found satisfactorily closed by completion of natural hemostatics, assisted by the temporary pressure.

A tumor placed over the course of large nerves, bloodvessels, or other important organs, may seem to be completely separate from them. Yet in many such cases the operator finds, during his dissection, that his previous examination has, to a certain extent, deceived him; the prolongations, even of a simple tumor, often extending to a much greater depth than was externally indicated. On the other hand, a large artery or nerve, passing through a tumor, may seem to be irrevocably incorporated with its structure. Yet, if this be not malignant, the artery or nerve, so situated, is not to be rashly sacrificed in the operation. They may pass innocently through, without being implicated in the structural change; and a careful dissection may leave them intact, yet without any portion of the tumor adherent.

Let dissection advance regularly, from one aspect of the tumor to another; and not by alternate cuts, or scratches, at various points. The procedure will thus be more seemly, simple, and safe.

In removing benign formations, firm, and circumscribed, from the vicinity of important parts—as bloodvessels, nerves, cavities, and canals—let the knife's edge play closely on the tumor, each stroke telling on its surface; and, by traction on the tumor, remove it at the same time as far as possible from the contiguous parts. Thus the latter are saved; while, at the same time, we can make sure that the whole of the diseased formation is taken away. But if the tumor be either avowedly malignant, or suspected of evil tendency, the incisions must be conducted on a precisely opposite principle. If the adjacent parts be such as not to admit of free cutting around the tumor, refrain from operation altogether. And, in all practicable and expedient cases, cut away from the tumor rather than on it. For, as already stated, unless a border of apparently sound texture be taken away, along with the tumor, we can never be certain but that many germs of the disease are left behind, rendering reproduction inevitable (p. 287).

The operator should never be in a hurry. If hemorrhage is troublesome, it can always be restrained either by pressure or by ligature. Hasty play of the knife, in the case of a simple tumor, may endanger important parts; which ought to have remained untouched. In the case of a malignant formation, there is not only the same danger, but a greater; there is the risk of leaving a portion of the morbid structure unremoved. In any operation, haste is inexpedient; here it is highly culpable. The knife should proceed leisurely; following the eye and finger, if need be. And, to make certain of entire removal, the extirpated part should be carefully examined at its cut margin; to see that no suspicious texture has been cut through, instead of having been cut away. If an unsatisfactory portion be detected, the corresponding part of the wound should be carefully dissected out; and, not until thus assurance has been made doubly sure, should coaptation be effected.

Operating in the axilla, or at [illegible] part of the neck, the larger veins should be interfered [illegible] ossible; tension of vascular parts previous to incisio [illegible] led; and the other means should be taken, which t [illegible] accidental entrance of air into the veins. It is during the dissection of deeply-seated tumors, in such localities, that this casualty is most liable to occur.

Some pendulous tumors, of a narrow pedicle—as certain of the adipose sarcomata—enlarge greatly in their free portion, and cover a large extent of surface. It is well first to amputate this pedicle, on a level with the surrounding skin; in order thereby to facilitate extirpation of the remainder. Pendulous tumors, sometimes, by their own weight, withdraw their deep attachments—which become more and more superficial; and in such cases, artificial traction may be made to assist the natural tendency—rendering the subsequent operation comparatively easy and safe.

Deep and massy walls of fat are inimical to adhesion of a wound. Therefore, in operating on subjects of obesity, it is advisable to remove a suitable portion of the subcutaneous fatty texture along with the tumor, by inclining the knife to the required extent.

In extirpating malignant tumors, especially the carcinomatous, we have to avoid both too sparing and too free removal of the integument. If over-anxious to have an easily coaptated wound, we may spare skin already involved; rendering reproduction certain. And, on the other hand, if much skin be sacrificed, reproduction will also be favored; by tightness and irritability of the cicatrix. When in doubt, it is well to err on the safe side; making every consideration secondary to thorough removal of the diseased parts.

When a large and deeply-seated tumor involves difficult and dangerous dissection, this may be facilitated by removal of the principal part of the growth first exposed; and simple bisection of it may sometimes answer the same end. Also, when the knife has gone as deeply, or as near to important parts, as seems consistent with safety, the remainder of the tumor—if simple—may be treated by ligature; as in the removal of central bronchocele, whose increase is interfering seriously with respiration.

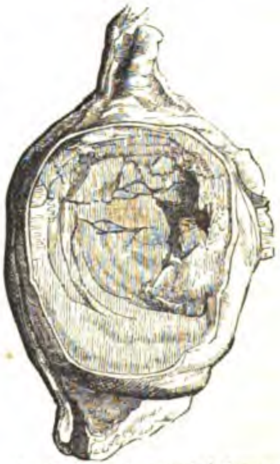
In the case of hopeless tumors, which preclude all attempts at extirpation, by their extent, vascularity, and important connection—and which at the same time threaten death, while yet occult, by interference with important functions—life may be prolonged and suffering alleviated, by division of external parts so as to relieve tension and permit freer outward growth. In large bronchocele, threatening asphyxia, for example, it may be expedient to divide the sternocleido-mastoid muscles, and perhaps also the cervical fascia, sub-integumentally.

Finally, let us guard against either error:—of wasting valuable time, in attempting to discuss tumors not amenable to such treatment; and of excising all which come under our cognizance, if locally practicable, without regard to ulterior consequences. In the first instance, we deprive the patient of his best, and perhaps only chance of safety. In the second, nothing but evil ensues, to all concerned. The surgeon, his patient, and his profession, all suffer; the two first perhaps irremediably.

Encysted Tumors.

The secreting cyst, which is the primary and most important part of this class of tumors, may be either an original structure, or adventitious; very frequently it is the former. The formation may occur in any part of the body: in the internal organs, as in the ovary; in the substance of glandular structures, as in the mamma. Then the cyst is of adventitious growth. But the most frequent site is on the surface of the body, more especially on the head and face; and then the cyst may be merely an enlargement of original texture. For there seems no reason to doubt the origin of many of these *Wens*, as explained by Sir Astley Cooper; namely, that they result from obstruction of an ordinary sebaceous follicle, and consequent dilatation by accumulation of its contents. Were the swelling rapid, and attended by inflammation, a pimple or boil would form. But the growth is very gradual, and wholly non-inflammatory. The sebaceous secretion accumulates, and distends the follicle; the parietes of which are not merely expanded, but receive support by nutrition, and by condensation of the surrounding parts. The obstructed orifice, for some considerable time, remains apparent as a black central point; afterwards, it wholly disappears; and the tumor is enveloped by smooth, tight, and thin integument, without breach or depression.

Fig. 90.



Section of an encysted tumor. The interior filled with a curdy substance.

The scalp, and eyelids, especially the upper, are the most frequent sites of such formations. In the former situation, they seldom occur singly, but in numbers; and vary in size from a pea to an orange. In the latter, they are often single; and seldom exceed the dimensions of a pea or bean. The cyst, if unirritated by pressure, friction, or other stimuli, is but loosely adherent to the surrounding parts; delicate in the eyelids; strong and thick in the scalp. After repeated or habitual excitement, it becomes intimately incorporated with the parts exterior; and can be separated from them only by regular dissection. The contents are various; at first sebaceous, being merely an accumulation of the ordinary secretion, somewhat perverted; afterwards, and usually soon, changes occur. Sometimes the contents are of semifluid consistence, like honey, and are termed meliceritous; sometimes like pap, atheromatous; sometimes serous, hygromatous; sometimes fatty, steatomatous; sometimes they have a fibrinous appearance; sometimes, in consequence of the cyst having assumed the inflammatory process, they are of a purulent character. By persistence of inflammation, an open condition may be produced, and a state of foul ulcer presented. And, under the circumstances last-mentioned, degeneration into medullary formation, or cancerous ulcer, is not improbable; more especially if the patient be advanced in years, and if the inflammatory accidents have been of frequent occurrence. Sometimes, after the open condition has been attained, all vascular excitement of an inflammatory kind ceases; and yet the part does not heal over in the ordinary way; but, assuming an extraordinary cuticular function, it commences a horny growth, which, if unopposed, may attain to large dimensions. Such horns, several inches in length, and bulky in proportion, have been cut from the forehead, and from various parts of the scalp. Sometimes calcareous matter, even in considerable abundance, is found in the substance of the cyst itself, and in its interior.

The contents of the thin cysts, which occur in the eyelids, are usually colorless and glairy. Not unfrequently, they contain hairs, of much delicacy, like stunted eyelashes; without bulbs, and more frequently unattached than adherent to the sac. Ovarian cysts are usually filled with contents more or less fluid; glairy and clear, or puriform in their character. Sometimes, they have been found to contain not only hair, but skin, teeth, and bones—as if the aborted development of another creature.

Treatment.—The superficial encysted tumors of the scalp, and face, are those with which the surgeon is most frequently called to deal. If recent and small, with the vestige of an obstructed orifice still visible, they may be got rid of by expression. With the point of a pin or probe, the aperture is re-established; and through this long strings of sebaceous matter may be squeezed out, by gradual pressure of the finger and thumb, until the cyst is emptied. The pressure may require repetition; the cyst contracts; the aperture remains pervious; and the normal condition is restored.

In the great majority of cases, however, there is no vestige of opening, the contents have ceased to be of a sebaceous character, and the method of treatment by expression is inapplicable. If the size be not great, and if the part have not been irritated by accident or design, the method by incision and evulsion is to be preferred; a method applicable to the great majority of encysted tumors of the scalp. The tumor is transfixed, and bisected, by a scalpel or bistoury. The contents are extruded, so as to disclose the cyst; and this, having been firmly laid hold of by well-pointed dissecting forceps, at its cut edge, is lifted out of its place, unbroken. If any adhesion prove stronger than was expected, it is to be touched by the edge of the knife, rather than that violence should be used in evulsion. It is seldom that any vessels demand ligature. After oozing has ceased, the integuments are carefully replaced and adjusted; and the treatment is conducted so as to favor adhesion.

When the tumor is large, redundancy of integument would result from the employment of this method: favoring suppuration, profuse and tedious. In such cases, therefore, excision is expedient. By two elliptical incisions, a sufficient amount of skin is taken away; as in the removal of a solid formation. And then dissection is proceeded with regularly; great care being taken that the knife do not puncture the cyst; otherwise, by escape of the contents, the tumor would collapse, and completion of the operation be much impeded. Also, in consequence of such misadventure, we might not be certain of having removed the whole cyst; a point which is indispensable in all cases. For, if the slightest part of the secreting surface remain, we may be well afraid either of reproduction, or at least of troublesome consequences.

To the slender cysts of the eyelids, neither the method of excision nor that of evulsion is applicable; the cyst is too delicate to admit of either. Incision, with cauterization, is to be practised. The cyst having been opened, its glairy contents are discharged; and a pencilled point of nitrate of silver is then applied to every part of the secreting surface. This is wholly destroyed; and, having come away in the form of a small slough, the space soon fills up and cicatrizes. For a structure of such delicacy, nitrate of silver is found to be quite a sufficiently powerful caustic. To use a stronger, would be to inflict unnecessary pain; and also, by destroying an unnecessary amount of texture, to endanger the occurrence of some deformity by cicatrization. Sometimes incision, followed only by thorough clearing of the interior by means of a probe, proves effectual; but, as a general rule, it is better to make the desired destruction certain, by a light use of the light escharotic.

An encysted tumor, inflamed and suppurating, is treated as an ordinary abscess; by free incision. No escharotic is necessary. The cyst is sufficiently disintegrated by the ulceration, which follows on the open condition. Healing, though probably tedious, takes place in the ordinary way.

When degeneration has begun in an encysted tumor, the part must be surrounded by free incision, and carefully dissected out, at as early a period as possible, according to the principles formerly inculcated.

Inflammation of an encysted tumor is never desirable; for the process is apt to prove excessive, unmanageable, and altogether untoward. In certain situations, it is by all means to be avoided. On this account, mere puncture of an encysted tumor of the scalp, however small and simple, is never expedient; inflammation and suppuration are sure to follow; erysipelas, in a dangerous locality, is not unlikely still further to nplicate the case; and lastly comes the risk of degeneration.

Removal of an encysted tumor, whose contents are serous, is quite ssible by absorption. The event, however, is so rare as not to warrant expectation of this in practice.

Encysted tumors, formed in the interior of a part, are best treated by regular dissection, as if they were of solid structure. The ovarian cysts require a separate consideration, which will be afterwards afforded.

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CHAPTER IX.

HEMORRHAGE.

INFLAMMATORY HEMORRHAGE AND EXTRAVASATION.

When the inflammatory process has approached its crisis, we have seen that the altered vascular coats are apt to give way; permitting the contained blood—liquor sanguinis and red corpuscles, in mass—to escape more or less copiously (p. 99). If this occur on a free surface, the accident is termed Hemorrhage; if in the interior of a part, Extravasation. The former most frequently takes place in inflaming mucous membrane, the blood escaping by the mucous outlet; and is not to be rashly checked, inasmuch as it generally tends towards a beneficial result. The implicated vessels are not only relieved of part—it may be the greater part—of their burden; but besides, a general resolutive effect may be obtained, as if the flow were an artificial one from a vein at the bend of the arm. In such cases, a practitioner, suddenly called, must take care not to suppose that to be of itself a disease, requiring immediate arrest, which is actually a means of cure directed against advancing inflammation—an occurrence requiring to be watched, perhaps favored, but only to be arrested when threatening to prove excessive.

When, however, the hemorrhage takes place into an internal space, it cannot be too soon arrested; and we would rather prevent it altogether, if possible; seeing that its presence, bulk, and pressure, may excite disease of a still higher grade, or seriously interfere with the function of neighboring parts. In the chambers of the eye, for instance, extravasation may hurry on the inflammatory process to ultimate disorganization of the eyeball; in the pericardium, the heart's action may be fatally overborne; in the membranes of the brain, coma by compression is established.

Extravasation is seldom but injurious, and therefore at all times to be avoided. Occurring in an internal organ, it occasions serious consequences, by arrest or impairment of function not only in that part itself, but also, perhaps, in others adjoining, by pressure made on them. Occurring externally, it is unfavorable, as indicating a high grade of the inflammatory process; one which is breaking up texture, and paving the way for suppuration.

TRAUMATIC HEMORRHAGE

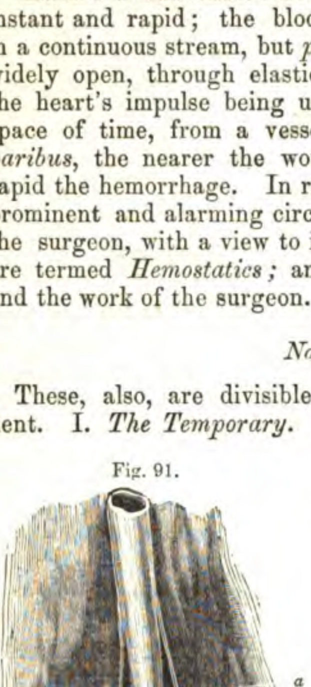
May proceed from wound of an artery, or of a vein, or of both. We shall first consider arterial bleeding.

ARTERIAL HEMORRHAGE.—When an artery is cut across, bleeding is instant and rapid; the blood of a florid red color; and ejected not in a continuous stream, but *per saltum*. The arterial orifice remaining widely open, through elasticity of the arterial coats, and energy of the heart's impulse being unbroken, much blood is lost in a very brief space of time, from a vessel of any considerable size; and, *cæteris paribus*, the nearer the wound to the centre of circulation, the more rapid the hemorrhage. In recent wounds, such bleeding is their most prominent and alarming circumstance; the first to claim attention from the surgeon, with a view to its arrest. The means suitable for this end are termed *Hemostatics;* and are of two kinds: the work of Nature; and the work of the surgeon.

Natural Hemostatics.

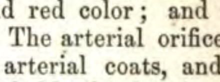
These, also, are divisible into two classes: Temporary and Permanent. I. *The Temporary*. 1. The artery, so soon as severed, *retracts*, in virtue of its elastic nature, within its sheath; leaving the extreme portion of that sheath, which does not retract—being without the same elasticity—vacant, and of rough surface. In that vacant space, coagulation occurs. Particles of fibrin become entangled and adherent to the rough points of its inner surface; and these constitute, as it were, nuclei on which others aggregate, to form a clot more or less extensive.

Fig. 91.



Plan of natural hemostatics, in a cut artery. At *a*, the cut end of the arterial tube; conical, by contraction. At *b*, the arterial sheath, vacated by the retracted artery, and occupied by coagulated blood. At *c*, the coagulum projecting from the orifice of the sheath.—JONES.

Fig. 92.

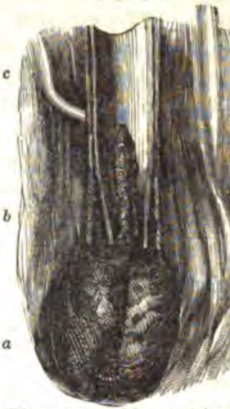


Retraction of a cut artery shown; *a*, the orifice of a dead artery; *b*, the orifice of a living vessel immediately after section.—SIR C. BELL.

2. Also, by virtue of inherent elasticity of tissue, the cut artery, while it retracts within its sheath, *contracts* upon itself, at the cut point; diminishing its calibre there; a vital action; producing a mechanical and obvious obstacle to profuse flow from the orifice—inasmuch as that orifice, at the moment of incision wide, is in a few seconds diminished to perhaps a half of its first dimensions. The more lax and free the surrounding areolar tissue, the more favorably is the vessel situated for contraction and retraction; and *vice versa*.

3. More direct obstacles are thrown in the way, however; by *coagulation* of a part of the passing blood. A coagulum forms in the vacant space of the arterial sheath, as already explained; coming ultimately to occupy that space altogether; often of a conical shape; its base resting on the cut arterial coats, its apex projecting in a pouting manner from the orifice of the sheath (Fig. 91, *c*)—as may be seen in the face of every recent wound. If the wound be open and free, there will be no other external clot; but, if otherwise circumstanced, a certain amount of sanguineous infiltration takes place into the surrounding areolar tissue; the blood, so infiltrated, solidifies; and a coagulum results, more or less extensive—by the pressure of which the arterial orifice is further diminished, and the first formed clot supported in its hemostatic office. The flow having been thus temporarily obstructed, a third coagulum forms; as after deligation of an artery; slim and twisted; its broad base resting on that of the first clot, at the cut arterial orifice; its slender apex on a level with the nearest collateral branch.

Fig. 93.



Plan of natural hemostatics, in a cut artery. At *a*, the external coagulum; incorporated with the coagulum of the sheath, opposite *b*. There also the internal coagulum seen resting on the external; and extending upwards as far as the first collateral branch, at *c*.—JONES.

4. These important changes are aided by the natural consequences of hemorrhage; mainly two. 1. As the blood flows, it becomes more and more *prone to coagulate*;[1] a state obviously most favorable to formation of the obstructing clots. 2. The patient is affected by a growing *faintness*, and tendency to syncope. The heart's action abating, and the general circulation becoming more and more feeble, contraction of the arterial orifice is favored, as also the construction of coagula.

In the distal orifice of the cut artery, similar changes occur as in the cardiac; and more readily. The contraction and retraction are greater; and, the blood's impulse being less, coagulation takes place with both greater speed and greater firmness.

By such means, in wounds of the smaller vessels, Nature is herself equal to the task of arresting the flow for a time. And if the coagula be not disturbed by reaction, permanent occlusion of the cut orifice is effected, in the following way: II. *The Permanent.* From the cut arterial coats fibrinous exudation takes place copiously; and becomes incorporated with the adjacent portions of coagulum, whose coloring matter disappears by absorption. The plasma, with perhaps a portion of the decolorized fibrin of the clot—though that is a question—becomes organized; the coats cohere by new and living texture; and the opening is permanently sealed. At the same time the surrounding tissues are condensed by infiltrated and organized plasma; whereby the permanent and fibrinous arterial closure is, as it were, supported and maintained. The coagula are now useless; their time and vocation have passed, and, in obedience to the general law, they dwindle down and finally disappear by absorption. At a more distant date, the like happens to the fibrinous exudation around; the parts again become loose, and resume their normal texture. The arterial orifice, and its permanently obstructing fibrinous mass, also undergo a similar change. The arterial canal has already contracted, up to the nearest collateral branch; forming a narrow cone, the base of which is at the collateral branch, the apex at the arterial extremity. This cone narrows more and more; ultimately the coats cohere, and the canal at that part may become wholly obliterated. Absorption continuing, the consolidated part shrinks to a mere thread.

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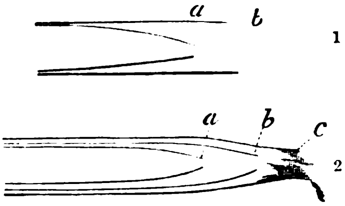
[1] Hallet. Lancet, No. 1177, p. 334.

In the process of natural hemostatics—wonderfully adapted to the end in view—there may be observed [illegible] similarity to that whereby a broken bone is united. First, t[illegible] of blood, which coagulates; then exudation of plasma, and abs[illegible] the coagulum; organization of the plasma, which is at first bulky [illegible]dundant; lastly, absorption of the adventitious structure, and restoration, more or less complete, of the normal state.

In the case of a lacerated artery, natural hemostatics are more readily effected. The orifice is more contracted; becoming, as it were, puckered; and reducing the flow to a more tiny stream. Also there is greater retraction; giving greater space in the vacant sheath, and consequently facilitating, as well as extending, coagulation there. The sheath is drawn at its extremity to a point; affording a more decided obstacle to passage of the blood than in the cut artery, and giving the vacant space a more decidedly conical form—favorable to coagulation. Further, the arterial coats do not retract together, as after simple division; but, giving way at different times, have different degrees of retraction. The internal and middle coats give way first, and together; they retract most, and remain coherent. The external coat affords most resistance, is most extended, and having at length given way, does not retract to the same extent as the internal and middle coats. So that the arterial orifice, as represented by the inner and middle coats, is, in the case of laceration, doubly protected; first, by a conical space formed by the equally contracted but less retracted external coat; and secondly, by the ordinary vacant space of the common sheath. In both of these situations, coagulation takes place; and so a double barrier is constructed against continuance of the arterial flow. In other respects, the process of occlusion is the same.

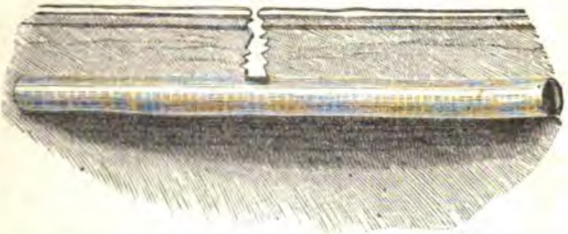
Fig. 94.



1. Plan of retracted artery, after section; *a*, the conical, contracted, and retracted arterial tube; *b*, the arterial sheath left vacant. 2. Plan of retracted artery, after laceration; *a*, the retracted middle and internal coats of the artery; *b*, the external coat; *c*, the twisted sheath.

When an artery is only partially divided, hemostatics are accomplished with greater difficulty. Neither contraction nor retraction can occur. The wound tends to remain open; and, if circulation be active —by reason of the size of the artery, or its propinquity to the heart— there is much risk of a fatal amount of loss, if Nature's efforts be alone trusted to. And yet it is wonderful under what circumstances a successful issue sometimes does occur. Cases are well authenticated, in which the aorta, and even the heart itself, have been punctured; and yet the patients have survived. Syncope having occurred, a coagulum formed in the wound; on occurrence of reaction the clot was not disturbed; but, remaining in the gap, it became the means of effecting not only temporary but permanent occlusion.

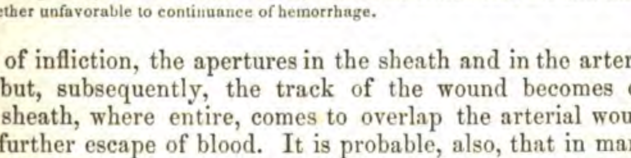
Fig. 95.



A punctured artery. The wound of the integuments uniform and continuous with that in the vessel; a state favorable to hemorrhage, existing at the time of injury.

In the ordinary circumstances of arterial puncture, the hemostatics are as follow:—Blood is infiltrated into the textures exterior to the sheath, and also between the sheath and the artery; in both situations coagulation takes place; and the pressure of the clots obviously tends to moderate the flow through the arterial canal, as well as from the arterial wound. By the infiltration, also, relative position is altered. At the moment of infliction, the apertures in the sheath and in the artery correspond; but, subsequently, the track of the wound becomes oblique; and the sheath, where entire, comes to overlap the arterial wound, preventing further escape of blood. It is probable, also, that in many cases coagulum forms in the arterial gap itself. And if the sanguineous flow have been much moderated by pressure from the exterior coagula, as well as by the faintness which loss of blood has induced, the obstructing clot may not be loosened or dislodged; but may remain, until removed by absorption, after consolidation of the breach by organized plasma.

Fig. 96.

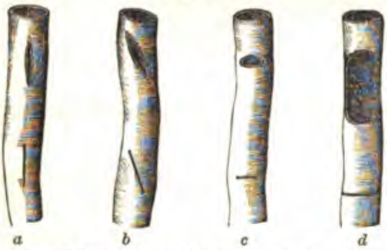


The same vessel, some time after the injury, in altered circumstances. The track of wound oblique, occupied by blood; and coagula also infiltrated into the surrounding areolar tissue. The arterial sheath slit open, showing bloody extravasation also there, between the arterial coats and their sheath; a condition altogether unfavorable to continuance of hemorrhage.

The deposit and organization of this plasma, in and around the gap, constitute the permanent hemostatics; as in the case of complete division. They may be such as merely to close the aperture, leaving the normal canal pervious; or the exudation may be to such an extent as to occlude the whole tube, and lead to obliteration at that point. The latter is the more frequent occurrence; and is indeed to be preferred; rendering the occurrence of either secondary hemorrhage, or aneurismal formation, less probable.

The result depends not a little on the form of wound. If a mere puncture, in the axis of the vessel, exist—there is no gaping; hemorrhage is comparatively slight, and the process of occlusion is easily effected; the tube remaining pervious. If the wound be oblique, gaping is considerable, bleeding copious, occlusion more difficult, and obliteration of the canal probable. The more nearly the incision approaches a transverse direction, the greater the gaping, the hemorrhage, the difficulty of occlusion, and the probability of obliteration. When it is not only transverse, but involves more than half of the vessel's girth, the gaping is great; the bleeding is with much difficulty controlled; and ulceration almost always occurs, to sever the undivided portion of the coats. Consequently, permanent hemostatics are then conducted in the same way, and very much under the same circumstances, as if the artery had been at first completely divided.

Fig. 97.



Plan of wounded arteries; *a*, a mere longitudinal slit, extending to an oval space; *b*, the same wound, in an oblique direction, gaping more; *c*, a less wound transverse, with the proportional gaping great; *d*, a transverse wound of the same size as *a* and *b*, causing a very wide hiatus.—LISTON.

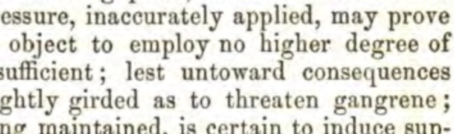
Surgical Hemostatics.

A most important qualification in the surgeon, called to a case of hemorrhage by wound, is absence of fear or alarm. And this valuable coolness can only be obtained by self-confidence; founded on an intimate knowledge of the means whereby the flow may be arrested, and on a conviction that he is perfectly competent to apply these effectually. His first duty is to expose the wound. Probably it has been covered up with bandages, or napkins, or cloths, by some alarmed and unskilful hand, in the vain hope of so stanching the bleeding. These must be all removed. His next duty is to expose the bleeding point. The wound will be found filled with coagulum, through which the blood wells out more or less copiously. This clot must be all dislodged, with the fingers or forceps. Then the cut orifice is seen sending forth its jet: and then, and then only, can that orifice be dealt with in an effectual manner. A small vessel, with a tiny stream, may be safely left to natural hemostatics; but when the calibre is at all considerable, and the jet active, there is no safety but in the employment of the surgical means of arrest. These are various. None are equal to the ligature, skilfully employed, as a general means; but some may often prove auxiliary to this; while others may conveniently supersede it in certain circumstances. We shall consider them in detail.

1. *Pressure.*—This may be used, when ligature is either unnecessary or inapplicable. For example, when the bleeding comes, not from one or two arteries of considerable size, but from a great number of small arterial twigs, or when it resembles rather a capillary oozing, ligature need not be applied to each bleeding point; pressure suffices. Or when hemorrhage proceeds from arterial orifices, imbedded in dense unyielding texture—as in the almost cartilaginous mass of soft parts which invest a necrosed bone, or in the substance of bone itself—deligation, if attempted, would probably fail; and here, again, pressure is to be preferred. It must be early, accurate, and steadily maintained. Early, in order to anticipate infiltration of the areolar tissue; by which aneurismal formation might be favored; or, at least, by which an obstacle, of greater or less bulk, would be interposed between the arterial wound and the compressing agent. Accurate; because a comparatively slight amount of pressure, applied directly to the bleeding point, suffices to arrest the flow; while a great amount of pressure, inaccurately applied, may prove ineffectual. And it is a great object to employ no higher degree of pressure than what is barely sufficient; lest untoward consequences ensue. The limb might be so tightly girded as to threaten gangrene; at all events, severe pressure, long maintained, is certain to induce suppuration and ulceration of the wound, whence secondary hemorrhage is not unlikely to follow.

Due pressure is applied in the following manner:—The wound, and the bleeding point in the wound, having been exposed, as already directed, the finger or thumb is placed accurately on the latter, so as temporarily to arrest the escape of blood; while an assistant carefully bandages the whole limb from below upwards, so as to afford a uniform degree of support to the whole, and prevent untoward consequences from the concentrated pressure which is about to be applied to the wound (Fig. 47, p. 240). The finger or thumb having been cautiously removed, a small, firm, dossil of lint—not larger than the finger's end—supplies its place; laid in immediate contact with the arterial orifice. Over this, another and another—each increased in size—are rapidly applied, till the wound has become filled with a graduated compress; of a conical form; its apex in contact with the arterial wound, the base projecting a little beyond the level of the surrounding integument; the whole fitting and filling the wound in every part. This accurately fitted compressing agent is then retained in its place by continuation of the bandage upwards; then the degree of pressure is regulated by the tightness with which the roller is drawn. The whole surface of the wound is compressed somewhat; but the main pressure is concentrated directly on the bleeding point.

Fig. 98.



Plan of a graduated compress. *a*, The artery wounded; *b*, *b*, the graduated compress arranged, so that the apex of the cone is in immediate contact with the arterial orifice, while its mass occupies the general wound, and projects somewhat above the integumental level.

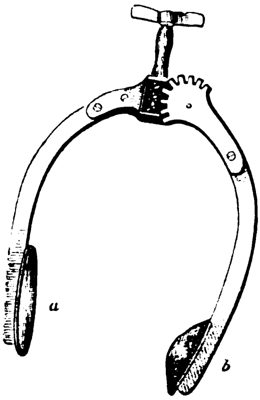
If the dressing remain dry and unstained by blood from beneath, it is a sign that the application is effectual; and it is left undisturbed. If, on the contrary, blood soon appear, and trickle through, the whole must instantly be undone, and reapplied more carefully. Blood, having oozed through the dressing, must have previously collected in the wound; coagulation has taken place there; and the interposition of a clot, between the compress and bleeding point, renders pressure inaccurate, and consequently ineffectual.

The dressing, when satisfactory in its immediate result, is retained for three or four days; unmoved and unabated. Then the apparatus is undone, and reapplied more lightly than before; and, having been retained for several days more, it may afterwards be wholly discontinued. In reapplication, it is well not to interfere with the deep part of the compress; if dry, accurately ap[illegible] adherent. And, after pressure has been wholly removed, t[illegible]t of the compress should not be taken out by forceps or finge[illegible]hould be permitted to come away, loosened by the discharge. [illegible]s the advancing occlusion by fibrinous exudation is disturbed, the better. The pressure may be likened to Nature's temporary hemostatics; restraining the flow, temporarily, by the intervention of mechanical obstacles; till time and opportunity are afforded, sufficient for permanent occlusion by organized plasma.

In the case of a slight wound of a large vessel, pressure may be so regulated as to effect occlusion of the arterial *wound* only; leaving the arterial *tube* pervious as before. But, as formerly stated, this is not only an unnecessary but a dangerous refinement in surgery; not unlikely to favor aneurismal formation. It is easier, safer, and altogether more advisable, to apply such an amount of pressure as shall obliterate the arterial canal at that point; not only temporarily but forever.

Pressure may be applied indirectly and temporarily; with the view of restraining hemorrhage, until the necessary means have been adopted for securing the bleeding points. Thus, in copious hemorrhage from a wound of the leg, it is advisable to compress the femoral, until direct hemostatics have been completed. For this purpose, the fingers or thumb of an assistant can be employed; and these are the best compressing agents, when steady and exact. Or a mechanical substitute, acting in a similar way, may be used; consisting of a strong steel spring, furnished with a pad at either extremity; one of which pads is applied accurately over the arterial trunk, the other resting on the opposite part of the limb. Or Signoroni's compressor may be employed. By either of these methods, pressure is confined to two points; and the evil consequences of uniform constriction of the whole limb are avoided. The mechanical contrivance is inferior to the living fingers in one particular; it is more apt to slip, and thus to endanger considerable loss of blood ere readjustment can be effected. But it has one equally obvious advantage. However tedious

Fig. 99.



Signoroni's compressor. *a*. The point of counter pressure; *b*. the pad which acts directly on the vessel.

the manipulations of the wound may prove, requiring long continuance of temporary pressure above, it is not liable to become unsteady and wavering from cramp or fatigue.

The most common expedient for indirectly and temporarily restraining hemorrhage, is the *Tourniquet;* a circular band, whereby the whole circumference of the limb is constricted; tightened by a screw, which at the same time forces down a compress or pad upon the vessel's track with a special intensity of compressing force. The objections to this instrument are:—the pain which tight constriction of the limb cannot fail to produce, and the favoring of venous hemorrhage which must necessarily result from so complete an obstruction of venous return. Its advantages are, that when applied, it is not likely to become displaced; and, with it, we are independent of an assistant.

Fig. 100.

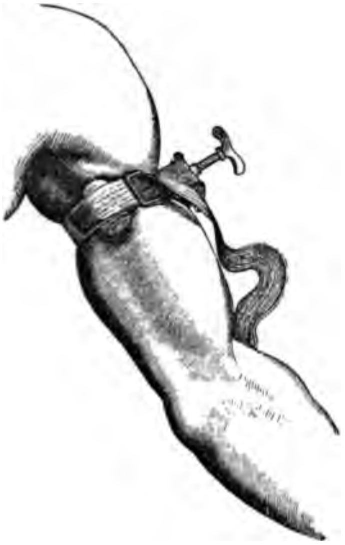


Fig. 101.

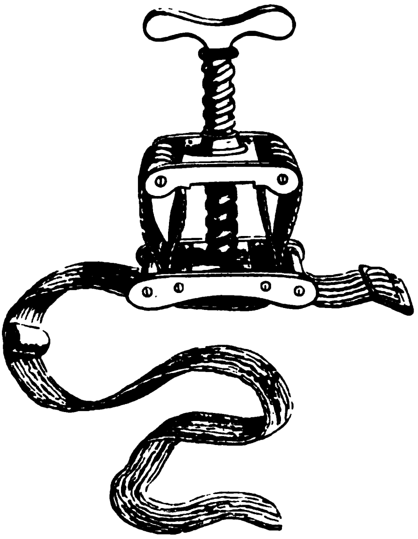
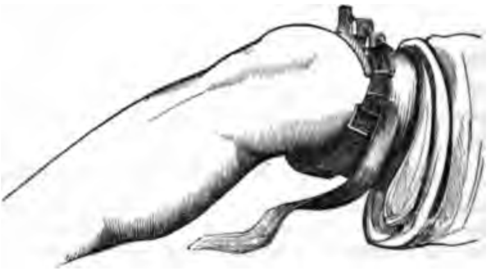


Fig. 100. The ordinary tourniquet shown in application to the brachial artery. A bandage enacting the part of compress over the vessel. Fig. 101. The tourniquet, unapplied; but with its two platforms as much separated, as if in actual use.

A very convenient form of the instrument is that invented by Dr. Malan; the screw flat, and double, admitting of the principal pressure being more rapidly and powerfully applied; and when adjusted, less in the way of the operator, and consequently less apt to be displaced by the accidental application of lateral force.[1]

Fig. 102.



Malan's flat tourniquet, applied to the popliteal.

2. When hemorrhage has occurred into an internal ca-

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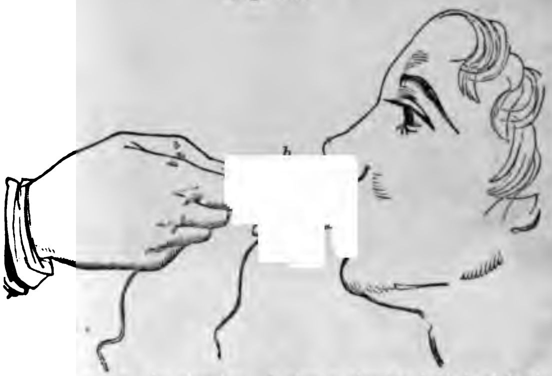
[1] Mr. Skey has contrived an efficient tourniquet, with the view of avoiding the evils of

vity or canal, whose parietes are not very extensile, the blood itself may be made, in part, the compressing agent. In profuse bleeding from the uterus, for example, we obstruct the vagina; in epistaxis, we plug the nares. The blood cannot escape; and, as it accumulates, it exerts pressure on its source. This mode of applying hemostatic pressure is ordinarily termed *plugging;* obviously most efficient when the compressing substance is placed in direct contact with the bleeding orifice, without any interposition of blood.

Fig. 103.



Example of arresting hemorrhage by plugging. A plug, *a*, about to be lodged firmly in the posterior nares, by means of the ligature, *b*. This having been done, and a plug afterwards placed in the front nares, the bleeding from *that* nostril is fairly commanded.

A very decided form of plugging is sometimes, though rarely necessary. In amputation, or operation on bones, for example, profuse and troublesome bleeding may take place from a large vessel imbedded in an osseous canal, and may refuse to be arrested by ordinary means. Pressure has been tried; ligature is inapplicable. The actual cautery is also inexpedient; for contraction of bone will not follow its use, so as to make the eschar impervious. Under such circumstances, if temporary direct pressure do not suffice, it is expedient to fit a piece of wood or cork into the aperture; securing it there, by the requisite degree of force. A portion of ligature is attached to the plug, and left pendent from the wound; and by this it is removed, so soon as the period of its usefulness has passed, and when it has become spontaneously loosened by the suppuration which its presence necessarily excites.

3. *Position* is important; so regulated as to retard and oppose arterial supply of the wounded part. The sanguineous flow being thus moderated, natural hemostatics are plainly favored. In wound of the hand or foot, for example, the injured part should be placed in as elevated a position as circumstances will permit, and so retained till hemorrhage has ceased.

4. *Cold.*—Cold is useful, not by superseding Nature's temporary

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uniform circular compression. "It is composed of two semicircles, one of which fits into the other by running in a groove. Each half is fixed by a spring catch to the other, and may be enlarged or reduced at will. In the centre of each semicircle is the pad for pressure and counter-pressure, the former being provided with the ordinary screw."—See his Operative Surgery.

hemostatics, as does pressure, but by assisting them. It is applicable to the slighter cases; to oozing, rather than to ejection of blood. Opening up of the wound, and exposure to atmospheric air, may often suffice. Or, this failing, a greater degree of cold is applied by means of lint, moistened in water; taking care that the cold is continuously maintained, either by the system of constant irrigation, or by very frequent wetting of the lint. At the same time, the part is left freely exposed, uncovered except by the wetted lint. This mode of treatment is in two ways useful; first, by tending to arrest hemorrhage; second, by tending to avert inflammation, and so to favor adhesion. The former indication is fulfilled by the cold repelling general circulation from that part of the surface to which it is applied, at the same time constringing the vessels; also, by increasing contraction of the cut arterial orifices, and favoring the formation of coagula.

5. *Styptics.*—These also are auxiliary to the natural hemostatics. Cold water may be ranked among the number; the simplest, and the most generally applicable. There are others, however, which have a more powerfully constringent effect on the arterial tissue; as gallic acid, turpentine, creasote, matico, solutions of iron, alum, zinc, mercury, &c. Of these, a strong infusion of matico deservedly stands high in favor; very astringent, and but little liable to hurt by excitement.

Whatever be their action, styptics may be generally rated as applicable only to the slighter forms of hemorrhage; more especially to cutaneous or mucous oozing; and even then, not advisable until the more ordinary and suitable means—cold, exposure to atmospheric influence, and attention to position—have been tried, ineffectually. For styptics, being usually more or less of a stimulant nature, are in their ultimate effects unfavorable to the healing process; inducing inflammation and suppuration; and so preventing adhesion.

Some substances, as agaric, cobwebs, felt of a hat, &c., adhere to the surface; at the same time entangling the blood and favoring the formation of coagulum; and thus they mechanically tend to arrest bleeding.

Certain of the styptics, when taken internally, assist in restraining hemorrhage. Gallic acid, matico, and turpentine, are especial examples of this class.

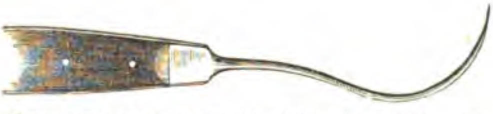
6. *Escharotics.*—These may be actual or potential. Of the latter class the *nitrate of silver* is generally employed. It has an astringent effect on the arterial tissue, like the more simple styptics; and besides, induces immediate coagulation of the sanguineous and other fluids with which it comes in contact, on the surface to which it is applied. This coagulum, further, is adherent to the texture beneath; and thus the remedy combines the two modes of action which the class of styptics was said to possess; constringing the vascular orifices, and at the same time covering them with an adherent mechanical obstruction. This is an admirable application in the minor cases of obstinate bleeding; especially in mucous and cutaneous surfaces. Often it may be trusted to alone in such cases. In others, of a more serious nature, it forms an excellent auxiliary to pressure. There are some cases of bleeding, partly arterial, partly by oozing, in which it is impossible otherwise to have the compress placed—dry and firm—in immediate contact with the

bleeding points; and, as stated previously, an inaccurate compress is likely to prove ineffectual. In such a case, nitrate of silver is first applied to the part; not so as to have a truly escharotic effect—killing a portion of texture, which must afterwards be detached; but simply so as to produce the hemostatic result formerly described. The bleeding is stanched for a time; it may be but for a moment. But even that short space of time is of much value; enabling us to apply the dossil directly and accurately to the part; without interposition of blood, either fluid or coagulated. The coagulum, made by the nitrate of silver, is but a thin film; in no way opposed to accuracy of pressure.

The actual cautery is a more severe remedy, to be reserved for more urgent cases; those examples of serious bleeding, for whose arrest other means are deemed inapplicable, or in which other means have been already tried, and have failed. As it sears the surface, the vascular orifices become shrunk, shrivelled, and charred; and this effect itself is powerfully hemostatic; the shrivelling being such as to obstruct the canal. But besides, all the textures of the burnt part are converted into a dead eschar, in thickness and extent proportioned to the intensity of the application. To constitute this eschar, the previously living and open texture is not only killed, but also condensed and contracted; and this change is to such an extent as to render the mass impervious to blood. This mass adheres to the living textures, around and beneath, until detached by the ordinary process of ulceration. So long as adherent, it mechanically restrains the flow of blood; and when loosened, it is probable that the ordinary concomitant and antecedent fibrinous exudation has sealed the vascular orifices, and permanently arrested hemorrhage. The formation and adhesion of the eschar may be likened to Nature's temporary hemostatics; the fibrinous exudation which precedes, accompanies, and follows detachment, to the permanent. If such fibrinous exudation be wanting or imperfect, the styptic effect of the cautery will be but temporary. Sometimes such is the case; and therefore, at all times, the period of the eschar's separation should be one of anxiety and care. At this time, if not before, it is well to take additional means for security; by the application of moderate pressure.

7. *Ligature.*—This is of all hemostatic means the most sure and satisfactory; and is not to be superseded or omitted, for light reasons, in any case of considerable hemorrhage from arterial wound. The effects of a firm round ligature, duly applied, will be spoken of in connection with deligation of arteries for the cure of aneurism; at present we consider only the mode of use. The arterial orifice is first laid hold of, and pulled outwards from the surrounding textures; in order that the ligature's noose may embrace it, and it alone. For this purpose, a sharp hook, termed a tenaculum, may be employed; but forceps are more convenient, and usually preferred. They may be such as are used ordinarily in dissec-

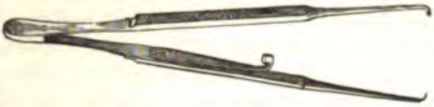
Fig. 104.



Tenaculum; or sharp hook, whereby the arterial orifice is picked out.

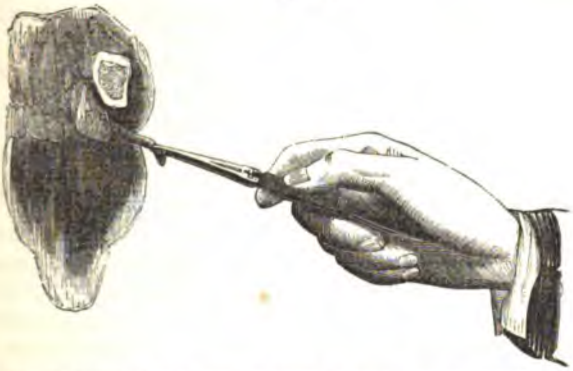
tion; not too sharp in their points, and with their prehensile surfaces accurately adjusted to each other. Or the spring artery forceps, with hooked points, may be used; and in most cases they are preferable. First, because maintaining a secure hold of the vessel—even when left to themselves, independently of the hand of the surgeon; and so, in the case of scarcity of assistance, admitting of the bleeding orifices being more rapidly secured. Secondly, because it is very difficult, if not impossible, for the assistant who secures the noose, to include the extremity of the instrument along with that of the vessel—a casualty not unlikely to occur with the ordinary forceps, among inexperienced fingers, or even with much expertness in a deep and narrow wound. Especial care is taken that nothing but arterial tissue is included in the noose; and, to this end, the surrounding textures are pushed back by the finger nail, if need be.

Fig. 105.



The spring artery forceps; ordinarily employed in preference to all other means, for taking up the arterial orifice.

Fig. 106.



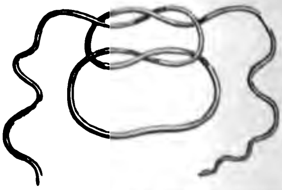
The forceps shown at work; after amputation below the knee. The artery fairly isolated, and made to project. Seldom it protrudes so far; but when it does, the ligature is applied close to the base, and scissors or knife amputates the redundant part.

By the interposition of other tissues than the arterial, at least three dangers are encountered. 1. The inner coat is not divided; does not resile from the bight of the ligature, and so become favorably situated for adhesion; but remains in its embrace, and must slough, inflame, and ulcerate. 2. Nerve or vein, being usually in close apposition to the artery, is likely to be included; and deligation of either is sure to induce results both painful and dangerous. 3. There is a larger extent of slough rendered unavoidable. For its separation, a proportionally great amount of inflammation and ulceration must ensue; and thus the danger of secondary hemorrhage is increased.

On the other hand, if the vessel, by laxity of the surrounding parts, be much protruded in an isolated state, the noose should be applied near the base of such projection; otherwise the vital power necessary for subsequent occlusion might prove deficient. In obedience to this sound maxim, it may happen that after application of the ligature, a considerable portion of bare artery is left dangling in the wound. It is well to abbreviate this, by knife or scissors; for obvious reasons. But in ordinary wounds this is seldo

The first noose is drawn tight force sufficient to endanger a tea h of all the tunics; but so as to insur , giving way of the internal and middl ts—a circumstance so essential to adhesion, and consequent permanent occlusion. The second noose is also firmly applied; and so as to constitute the reef-knot; one which will neither slip, nor be pushed off by the arterial impulse.

Fig. 107.



The surgeon's knot roughly shown; not yet tightened.

In this manner, each vessel is tied; rapidly, so as to prevent unnecessary loss of blood; yet not hastily, so as to endanger carelessness and inefficiency of deligation. Every vessel which is plainly arterial, and plainly bleeding, should be secured. In an extensive wound, there are muscular branches which seem small and unimportant, after we have just completed the treatment of the larger trunks; the patient is probably by this time faint; and the bleeding from these points may be little more than mere oozing. Still, experience inculcates the expediency of deligation being extended to these. Otherwise, so soon as reaction has been fairly established, natural hemostatics are overborne, and copious hemorrhage ensues. What were before mere oozings, are now distinct and rapid streams, each demanding ligature; and rendering a painful undoing of the wound, for this purpose, absolutely indispensable. To avoid this, such vessels should always be tied at the same time, and in the same way, as the larger trunks. Better apply one or two ligatures, even unnecessarily, than encounter the risk of secondary bleeding—perhaps seriously injurious; and of secondary deligation—always troublesome and painful. In reference to this subject, it is well to remember that it is not an ordinary reaction with which we have to do; but one whereby the wonted contents of the obstructed main vessels are thrown upon small collateral branches, which, in consequence, are unusually excited to hemorrhage.

When an artery has been cut obliquely, as is likely to happen in amputation by flaps, especial care must be taken that the orifice is well pulled out from the surrounding textures, previously to deligation; otherwise, the noose may be thrown upon the oblique arterial wound, instead of beyond it, and the artery, thus left partially open, cannot [illegible]

If an artery be not cut across, but merely punctured, two ligatures are essential; one above, the other below the punctured part. One ligature, on the cardiac aspect, may arrest bleeding for a time; but, so soon as collateral circulation has become fully established, the distal orifice will bleed almost as profusely as did the other. There is no safety but in two ligatures. And the same rule holds good in regard to an artery, when cut across, whose distal orifice remains imbedded in living texture. For example, in amputation of the thigh, the femoral artery requires but one ligature; but if a mere wound be made in the thigh, implicating that vessel, both distal and cardiac orifices must be secured; free dilatation of the wound, if necessary for this end, being unhesitatingly performed.

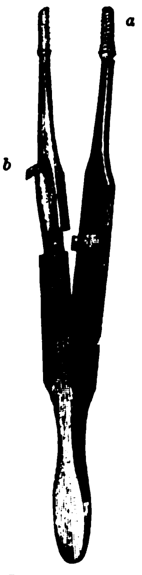
Sometimes an arterial orifice is surrounded by textures so dense, as to render the ordinary use of ligature impracticable. In such a case, if pressure fail, or seem unsuitable, we may be compelled to apply the ligature somewhat clumsily; in order to avoid the greater evil of unnecessary loss of blood. A curved suture-needle is passed through the bleeding point; so as to transfix it, and yet include as little as possible of the surrounding parts; and, around the needle's convexity, the ligature is secured. The needle is then either withdrawn, or permitted to remain for a time; according as circumstances may seem to indicate. Unless the knot be drawn very tightly, it will scarce fail to slip, on immediate withdrawal of the instrument.

When the bleeding points have been all secured, the ligatures then come to be arranged, with a view to dressing the wound. If this be left open to suppurate, and heal by granulation, both ends of each ligature are cut away close to the knot; the knot loosens in due time, and passes away with the discharge. If, however, we intend to bring the wound together, and treat it for adhesion, one half only of the ligature should be cut away, the other being left pendent from the wound; in order that separation and discharge of the noose, with its enclosed slough, may be watched and made certain.

By some, both ends are cut away; in the belief that adhesion is thus favored, throughout the line of wound—as doubtless it is; and in the hope that the noose will become encysted, and give no further annoyance—as certainly will not happen. Adhesion under such circumstances is a misfortune. For the noose and its contained slough are to all intents and purposes foreign matter; as such, their presence will be resented by the surrounding living textures; and, as such, they will be extruded by suppuration. Sooner or later—often after cure has apparently been completed—deep abscess forms; painfully and slowly having approached the surface, pus is discharged—and with it, its cause, the noose. Not until this latter has been put forth, will the pain and discharge cease. Or, before this, the arterial coats may have been too far encroached on by the pent-up collection; they have become ulcerated, perhaps at a part where the canal is yet free; and secondary bleeding ensues.

. *Torsion.*—This is an imitation of the means whereby the lower
s, in parturition, by gnawing and twisting the umbilical cord,

Fig. 108.



Torsion forceps; *a*, the points accurately and sharply serrated, so as to bite deeply into the arterial coats; *b*, the slide which, when shut, secures the vessel in the embrace of the instrument.

instinctively arrest its hemorrhage; and an adaptation of the general fact, that torn arteries, more readily and effectually than the cut, undergo natural hemostatics. The arterial orifice is pulled outwards, by forceps, to the extent of half an inch or so. The base of this isolated part is then seized transversely by other forceps, which hold it securely; and by whose grasp the internal and middle coats are probably divided. While this instrument is steadily held, the extremity of the vessel is, by means of the evellent forceps, twisted several times upon itself. It is then left pendent in the wound.

This method is o[illegible]pplicable to arteries of the second class. The s[illegible] vessels cannot be so treated easily; the larger cannot be so treated with safety. In every wound, therefore, wherein the three classes of vessels are implicated, some ligatures must at all events be applied; and it is not easy to see what disadvantage can accrue, from deligation being extended to all. Application of a ligature can be effected in fully as short a time as torsion; and when applied, the ligature is undoubtedly a more certain hemostatic. The twisted portion of the vessel must slough and separate; the noose of a ligature is not more truly, or to a greater extent, a foreign body. Torsion, therefore, is never superior to ligature; and it is doubtful whether, under any circumstances, it may be considered equivalent. Its use is expedient only in the case of a second-class artery, when, from scarcity of assistants, want of apparatus, or other accidental circumstances, deligation is inconvenient. In this country, it is seldom employed; unless indeed, this be called Torsion—namely, when, seeing a small arterial orifice which scarcely demands ligature, we seize it with the ordinary forceps, give it two or three turns, and then expect to find it silent.

9. *Nauseants and General Treatment.*—One of Nature's hemostatics we found to consist in faintness, supervening on loss of blood. This may be imitated by art; ere yet so much blood has flowed as to establish the natural result. The means are valuable in cases of internal hemorrhage, as from mucous surfaces; to which pressure, ligature, and the other more direct hemostatics are inapplicable.

The patient is made sick and faint; so that blood may circulate more slowly and gently in the wounded part; favoring coagulation. Actual syncope is not wished; for reaction is likely to follow, and by it bleeding may be reinduced. Neither is actual emesis sought; for that includes violent muscular exertion; and is also likely to be followed by reaction; both circumstances favorable to bleeding. Derivative bleeding from the arm has been practised for this purpose; but nearly the same end may be obtained by the exhibition of such simple nauseants as ipecacuanha or antimony, while yet the important fluid is spared within the veins.

Rest—including repose of both body and mind—low diet, cool drinks, ices, and the general regimen suitable for moderation of the circulation, will not be neglected.

In urgent hemorrhage, opium is of great importance; given in moderate doses, frequently repeated; on an average, half a grain or a quarter of a grain, every half hour—but the interval necessarily varying according to the effect produced. Its main action seems to be by imparting to the system a power of bearing up under the loss of blood; and at the same time it may assist in obtaining hemostatic results. Some suppose that the preservative action is by inducing congestion of the brain—"That amount of congestion by which opium occasions apoplexy, when given to persons in health, seems only sufficient to sustain the natural and necessary tension of the cerebral vessels in those who are dying of hemorrhage."[1] Accordingly, large doses may be given to produce such congestion. But such large doses, if they produce full narcotism, must obviously prove injurious.

Syncope.—This, when temporary, is Nature's last resource in cases of urgency. By its occurrence, arresting all flow for the time, lives are often saved; opportunity being so afforded for use of the required surgical means.

Unless bleeding has been satisfactorily stopped, by treatment of the wound, the condition of faintness is not to be disturbed. When, however, all has been duly overtaken, and syncope still continues; we naturally become anxious that the patient should emerge from that state. The means are simple. The cause of syncope is twofold: deficient supply of arterial blood in the nervous centres, suspending their functions; inadequate stimulus to the heart, retarding its play. Both are to be counteracted. The patient is placed recumbent, and all means taken to leave respiration unimpeded—as by slackening or removing tight articles of dress from the chest. The head is placed rather lower than the rest of the body, so as to favor the flow of blood thereto. It is a very mistaken kindness to prop the head with pillows, and otherwise endeavor to give it the appearance of comfort. The heart still acting feebly, and much blood having been lost, it is well to compress the abdominal aorta and axillary arteries, so as to husband what of the vital fluid remains, and keep it circulating where it is most required; in the chest and head. By dashing cold water on the face, applying stimuli to the nostrils, rubbing and compressing the chest, respiration is favored; and by the full establishment of this, the heart will be forced, as it were, into renewed play. In desperate cases, galvanism may be employed to restore function in both heart and lungs.

Transfusion.—This is the last resort in cases of perilous hemorrhage. Warrantable, nay demanded, when circumstances are favorable for its practice; and when there is good prospect of the patient's ultimate survival, were the immediate risk by loss of blood removed.

There is no time to recruit the circulating system, by chylous elaboration on the part of the patient. The blood required, to atone for the existing deficiency, must be immediately supplied; and can be obtained only from some fellow-being who is generous enough to afford it. For obvious reasons, a robust healthy person is preferred.

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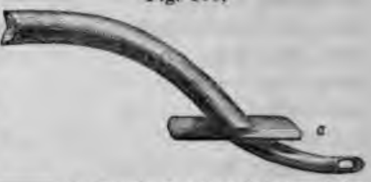
[1] Brit. and For. Rev. 41, p. 107.

A syringe, with suitable tubes and nozzles, is made on purpose for the operation. This apparatus, seen to be scrupulously clean and well adjusted, is brought into the same temperature with the body. A vein in the arm of the patient is laid bare, and an incision made of sufficient size to admit the tubule through which injection is to be made. Blood is then drawn in the ordinary way from the emit- [illegible] patient; and as it flows into a b[illegible] it is steadily injected into the recipient; care being taken that no air or coagulum is permitted to enter. And to avoid the former accident, the tubule is not inserted into the vein, till the syringe has expelled its air, and blood is flowing freely. Or, the syringe being provided with two tubes and nozzles—an afferent and efferent, a direct communication is made between the emitting and receiving veins. The effects are watched; and the amount of injection is regulated accordingly. On an average, from half a pint to a pint will suffice to restore life and circulation. Rapid or excessive injection would be liable to overburden the heart, and produce serious consequences thereby.

Fig. 109.



[illegible]e for insertion into the vein in transfusion. [illegible]hield which, compressing the integument, [illegible]s outward escape of the blood.

Accidents by phlebitis, in either patient, are not unlikely to occur; and must be duly cared for. On this account, the operation is not expedient except in otherwise desperate circumstances.

Secondary Hemorrhage after Arterial Wound.

In all cases of serious wound, whereby important arteries have been implicated, there is risk of secondary hemorrhage. And this may occur at various times, and from different causes. It may happen within a few hours after the first dressing; so soon as the patient has become hot and comfortable in bed, and reaction has been fully established. A ligature, clumsily applied, may have been pushed off. More probably, some of the oozing vessels, formerly described, have been overlooked, and unwisely spared from deligation. The wound must be undone, the bleeding surface fully exposed, and each vessel now carefully secured.

Or sloughing may attack the wound, and unoccluded vessels thus be opened into. If the slough be but partial, and the opened artery not large, pressure will probably suffice. If not, then the vessel may be exposed, by direct incision, at the bleeding point; and a ligature placed above and below the aperture. Should the attempt to secure the distal portion of the vessel fail, the cardiac ligature, with exact and moderate pressure on the wound, may be alone trusted to; and in all probability it will prove successful. If the sloughing be general, or the vessel large, the main artery of the limb must be secured, by incision on the cardiac aspect.

Or an artery which has been secured by pressure and natural hemostatics, at the time of injury, bleeds within a few days; and there is neither ulceration nor sloughing in the wound. This is found filled with coagulum; and is lined with a fibrinous exudation. In such circumstances, the wound is dilated by direct incision; and, the bleeding point having been exposed, the vessel is secured by ligature; this being double —above and below the bleeding point—in all cases where the artery may bleed again from the distal side. Sometimes detection of the vessel is facilitated, in a deep wound, by the circumstance of its orifice being surrounded by a greenish-yellow discoloration.

Or a vessel, which at the time of injury was tied, bleeds in consequence of ulceration of an asthenic kind, at the time of the ligature's separation; as after deligation on account of aneurism. In this case, some considerable time usually has elapsed; eight, ten, or twenty days. The parts implicated have become infiltrated, and are changed both in structure and in relative position. Besides they are the seat of asthenic ulceration; and, for the time, all these textures are incapable of healthy vascular function. In such circumstances, detection and isolation of the bleeding orifice will be difficult; and when found, the prospect of obliterative changes by deligation is not promising. The likelihood is that the thread will come away too soon, leaving an open vessel, and again determining hemorrhage. Instead of a direct incision, therefore, it is better to tie the main artery, at a sound part, on the cardiac side; maintaining exact, continuous, and moderate pressure on the original wound. At the same time, the general means suitable for the restraint of secondary hemorrhage are not to be neglected.

Of late, there has been a good deal of discussion as to the proper treatment of secondary hemorrhage after arterial wound. But the sound practical conclusion seems to be this. It is always desirable to tie the vessel above and below the bleeding point, by direct incision; and that should always be done when practicable, and when there is a fair prospect of the ligatures "holding." But when, either from long time having elapsed, or asthenic inflammation having supervened, direct deligation has been rendered impracticable, inexpedient, or both, then cardiac deligation should be resorted to, as in the case of aneurism; with pressure on the original wound, or not, as circumstances may seem to indicate.

Venous Hemorrhage.

Venous blood, as contrasted with arterial, flows in a dull and dark stream; but, by continuance, not less capable of perilling life by syncope. Pressure is the general and preferable means for its arrest; along with removal of all obstruction to venous return. In amputation, for example, it sometimes happens, that after the arterial jets have all been secured, dark streams continue to issue somewhat profusely from the venous orifices. Our first care is, to see that all pressure from above has been removed; whether by tourniquet, or by the fingers of an assistant. Such removal often suffices, of itself, to stanch the flow. If not, let pressure be employed; either directly on the venous orifices, or by approximation and compression of the lips of the wound. After a few minutes, let the pressure be gently removed; and then, usually, bleeding will be found to have finally ceased. If not, let a compress of lint be applied to the bleeding point or points; graduated, secured, and maintained, as if for an artery similarly circumstanced; only with less intensity of pressure; a comparatively slight amount of this, if direct and accurate, being sufficient to restrain the flow. By this means, the venous coats are held in undisturbed contact; fibrinous exudation takes place from them, and from the surrounding parts; the plasma becomes organized; and by it the venous canal is effectually and permanently occluded.

By every means in our power, we ought to avoid deligation of a vein. The tissue is not suited for, and is apt to resent, use of the ligature. The internal coat is not divided, as in the artery; but is simply puckered together in folds, and so includ[illegible] ose. The included portion must die; and, being dead, it m[illegible] hed. By no other process than by inflammation, causing ulce[illegible] n its detachment be effected. Consequently it is imperative that [illegible] rnal coat shall become truly inflamed; suppurative phlebitis of a portion of it must ensue; it will afterwards be seen how prone phlebitis, especially in its higher grade, is to spread; and, therefore, it need be no matter of surprise to find the very worst form of that formidable disease, the suppurative and spreading—supervening on the application of ligature to a vein. Limited suppurative phlebitis is inevitable; and it is very apt to become spreading and diffuse.

It may, and does, happen occasionally, that no accident ensues; that the ligature ulcerates its way out; that fibrinous exudation extends around; that the vein is permanently occluded; and that the inflammatory process does not seek either a high grade or an undue extent. Yet undoubtedly the risk of an opposite result not only exists, but is great; and should not be unnecessarily incurred. The only circumstances which demand deligation of a vein, are those in which loss of life by loss of blood is otherwise impending. Such circumstances occur but seldom. In the great majority of cases of venous bleeding, as already stated, pressure is sufficient; along with removal of obstruction to venous return, on the cardiac aspect of the bleeding point.

Puncture of a vein, if the vessel be not very large, or placed near the centre of circulation, closes readily by natural hemostatics alone. The flow and force of blood in the wound are comparatively slight; coagulum forms readily, and is not apt to be dislodged. If the puncture be longitudinal, the lips remain in apposition; and simply cohere by adhesion. If it be oblique or transverse, there is more or less gaping of the wound; which, however, soon becomes occupied by coagulum; and this is strengthened, and supported in its place, by clots formed in the external areolar tissue. Fibrinous exudation takes place from the margins of the wound, and is incorporated with the clot; the exudation becomes organized; and, as it does so, the coagulum disappears by absorption. Ultimately a new membranous expansion is constructed—continuous with, and furnished by the original coats—whereby the chasm is permanently and efficiently closed. The obstructing clot was, as it were, the scaffolding or mould whereon the new structure was formed; and, when the latter became complete, the former was undone and removed. The external coagulum is also absorbed; the new membrane becomes incorporated with the ordinary areolar tissue; and the part in all respects resumes its normal condition. The venous canal may be obstructed, by excess of coagulum and fibrinous exudation, at the wounded point; but usually it remains pervious and unchanged; a striking difference from the ordinary result of the corresponding process in arterial tissue.

Puncture of an artery may, and sometimes does, simply heal in the same way as a vein; that is, by an obstructing coagulum, on and in which a reproduction of the coats is effected; while the canal remains free. But the comparative impetuosity of the blood's flow is a fatal obstacle to the general occurrence of such a mode of cure.

The Effects of Loss of Blood.

Sudden Death from Profuse Hemorrhage.—Examples of this accident are interesting to the surgical pathologist, merely in a scientific point of view. The practitioner seldom if ever sees such cases, before the fatal event has rendered his visit useless. A man, in committing suicide, cuts deeply into the neck; wounding the large vessels; and almost immediately falls down a corpse. The murderous instrument may be found firmly grasped in the clenched hand; a convulsive spasm of the muscles of the whole body having preceded death. Or the man may have died without a struggle; and the weapon is found lying beside him, having fallen from his hand when the wound had been made.

The rapidity with which death arrives is, of course, dependent on the amount of blood lost in a given time, and on the previous state of the constitutional powers of the patient. The influence of this latter circumstance is undoubtedly extremely insignificant, in the class of cases now alluded to. But it will come to occupy a more important place, when we consider the effects of a continued loss or draining of blood from the system. The former circumstance, viz., the amount and rapidity of the hemorrhage, has an obvious bearing; for if the bleeding be not excessive, the surgeon may by timely measures rescue his patient from death. And it is in cases where a short time (say a few minutes) elapses before the fatal event, that we have occasionally an opportunity of studying its circumstances.

The history of such cases is extremely short. In surgical practice, they are most frequently exemplified in wounds, in secondary hemorrhage, and in the bursting of external aneurisms; in the practice of the physician, in the bursting of internal aneurisms, and in mucous hemorrhages; and in the practice of the obstetrician, they are occasionally but rarely seen, in cases of uterine hemorrhage connected with advanced pregnancy or labor. The surface of the body becomes deadly pale and cold; the voice is altogether gone, or almost inaudible; syncope occurs; and, probably in convulsion, the patient dies. If death does not take place immediately, the first faint may pass off; the eye becomes glazed, and the pupils are dilated, the mouth grows dry and cold, thirst is urgent, the patient sighs oppressively, and may be able to toss his head to relieve the extreme feeling of uneasiness which oppresses him. Generally he retains his mental faculties to the end; a last attack of syncope supervening, and carrying him off either quiet or convulsed.

Effects of a Continued Loss of Blood.—A man may fall down suddenly in a faint, from accidental loss of blood, without sustaining from that loss any serious injury whatever. Either syncope itself, or timely outward assistance, arrests the hemorrhage; he recovers from the faint; and nothing of any importance results. But if within a short time this hemorrhage is again and again renewed, it is no longer innocuous. Recovery from the state of fainting is then not perfect; but may be accompanied with more or less delirium, or with an excessive feeling of anxiety, or with jactitation, violent rigors, or even convulsions; and, in the severest cases, with involuntary evacuation of the bladder and bowels. Further, the depression immediately resulting from the hemorrhage comes to be followed by a train of symptoms, to which the name of fever, or the *fever of reaction*, has been applied (p. 140).

This state of the circulating system becomes occasionally a formidable and difficult complication. A patient has received serious injury of a limb, attended with much hemorrhage. And in deciding upon the propriety of at once operating in such a case, or of delaying interference, we must consider not only the nervous and constitutional shocks which the patient has received (p. 81); but we must consider also, whether or not the organs of circulation can safely continue their functions, under the additional but comparatively slight loss of blood caused necessarily by the operation. Many cases are on record where they have suddenly failed under such circumstances.

Nothing can be stated, absolutely, as to the amount of hemorrhage which is necessary to induce the fever of reaction; neither can any particular period for its accession be specified. In these particulars, there is every possible variation; according to age and constitution. The young and the old, the weak of all ages, and generally those of a sanguineous temperament, feel most acutely all the different effects of profuse hemorrhage.

The fever of reaction speedily disappears, if hemorrhage is quite arrested; but if a drain of blood still continue, the fever certainly returns, though with less violence; and may be repeated again and again, till at last it subsides into a state of gradual sinking followed by death.

This fever of reaction is characterized by extreme weakness, combined with great excitement of the circulation (p. 140). The pulse is frequent, but soft and jerking; giving to the finger the sensation of a violent propulsive stroke from the excited heart, acting on the contents of an imperfectly filled vessel. There is generally a painful feeling of pulsation in all the large arteries, and especially in the aorta; also headache or giddiness, sometimes low delirium, intolerance of light and sound, hurried breathing, and great feeling of anxiety in the chest.

The Treatment of the constitutional effects of loss of blood is extremely simple in its plan. The patient is to be placed in a large airy room, in a recumbent posture, without pillows under the head. Stimulants should be administered as circumstances may seem to require. And if transfusion is considered necessary, it should be performed without delay (p. 322).

If the convulsions and delirium, which are often present, seem to be connected with congestion in the head, some simple derivatives and counter-irritants may be necessary; as dry-cupping to the nape of the neck, if depression of the pulse is not extreme; or the application of sinapisms, or even blisters, to various parts of the body. But, under all circumstances, the use of stimulants is to be continued; forming, as it does, our chief indication. At the same time, the patient should be freely supplied with mild nourishment. And, as already stated, a prudent use of opium will be found of the greatest value (p. 321). Such medicines as camphor, musk, ether, &c., may also be useful; to allay the nervous excitability of the heart.

Anæmia.—When loss of blood is not at once carried to such an extent as seriously to affect the system, but has been continued for a long time, or frequently repeated, it gives rise to a series of constitutional symptoms which are classed under the term *Anæmia.* These symptoms, although in themselves apparently of a serious and alarming nature, are chiefly interesting to the surgeon as indicating the effect of continued sanguineous discharge. He knows that by removing the cause of the hemorrhage, he will not only cure the original complaint, but also afford the only sure means of relief from the secondary constitutional symptoms; which may have seemed to the sufferer by far the most important and distressing part of the case.

At the same time, the anæmic state, when it exists in an aggravated degree, is itself a matter of great importance. It forms a strong predisposing cause of various diseases; more interesting to the physician, perhaps, than to the surgeon. And the source of this increased tendency to certain morbid states of the system, is to be found in the altered state of the blood. When a single hemorrhage occurs, by accident or intention, the only subsequent change to be discovered in the blood, is a diminution of the number of red corpuscles. But if bleeding be long continued, or often repeated, the blood is found impoverished, not only in the amount of its colored globules, but also in that of solid matter in the liquor sanguinis (p. 138). It has in fact become watery. The red globules, the fibrin, and the albumen, are all in abnormally small proportions. It is this state of the blood which is characteristic of anæmia; and which renders the patient liable to passive dropsy, in any of the shut serous cavities, or in the general areolar tissue; as well as to morbid congestions in the parenchymatous organs. And it is well known that these last may, under any accidental exciting influence, become the starting-point for chronic inflammatory disease of a formidable kind. The exudations, in such circumstances, have a tendency to some low form of development. And hence, in the lungs and kidneys, their most frequent sites, we find the morbid process prone to tubercular and unhealthy fibrinous deposit; in the latter case producing a change of structure characteristic of some forms of Bright's disease.

Besides, the state of anæmia predisposes strongly to attacks of epileptic convulsions, syncope, palpitation of the heart, asthma, hysteria, colic, partial paralysis, chorea, and a long list of other functional diseases; or diseases of innervation.

The constitutional symptoms of anæmia are a pale, waxy appearance of the countenance; pallor of the lips, and mucous membrane of the mouth; weakness of sight, or even amaurosis; vertigo, or giddiness in the head; a weak, and easily excitable pulse; dyspnœa after the least exertion; tendency to sickness and vomiting; irregularity of the bowels; weakness of the limbs; and a general feeling of excessive lassitude.

In surgery, cure is obtained by direct interference; namely, by putting an effectual stop to the sanguineous discharge. If a pile or polypus has been bleeding, it is tied, and taken away; if the blood has proceeded from an open ulcer, in any of the mucous passages, it is cauterized and healed up. At the same time, suitable medical treatment is employed, to hasten and establish convalescence. The principal remedies, with this view, are bark and iron, as tonics; and opium, as a sedative, in small doses; or hyoscyamus, camphor, &c. On a well-managed generous diet, however, our chief reliance should be placed; as, after all, the best tonic and restorative.

The Hemorr[illegible] Di[illegible]hesis.

By this term is meant a tendency to bleeding of an uncontrollable kind, from slight breach of surface; not arterial, by jets; nor venous, in full stream; but capillary, by oozing. In the case of an extensive wound, occurring in a patient so affected, the larger arterial branches might be secured as usual by ligature; the venous orifices might either give no trouble, or become closed by pressure; yet bleeding would continue from the numberless capillaries; threatening to end fatally, notwithstanding all hemostatic means. This peculiar state of system may be either original or acquired. Most frequently it is the former; and seems to be hereditary, besides; descending chiefly, not solely, in the male line; disclosing itself at an early age, and abating as age advances. The state seems often to fluctuate; a scratch at one time threatening fatal loss of blood, at another scarcely attracting attention. And in some patients distinct periods of remission and exacerbation may be observed. At the latter times, the patient is subject to frequent attacks of pain and swelling, with ecchymosis, of the wrists, ankles, and knee-joints; attended with fever. These symptoms continue generally about a fortnight; and then disappear, with subsidence of the swelling and removal of the ecchymosis.

The diathesis has many points of resemblance to both the scrofulous and the scorbutic; and, like these, it has its marks of indication. The most prominent are—an obvious delicacy of system; usually a fair complexion; a thin transparency of skin; irritability of the circulation at all times; occasional febrile accessions, as formerly described; tendency to ecchymosis from the slightest cause, as also to hemorrhagic oozings from mucous surfaces; every scratch, even in other respects the most trifling, causing alarm, trouble, and sometimes danger, by continuing to bleed.

The cause would seem to be twofold: a morbid condition of the blood, and also of the capillaries. The blood looks thin and ichorous. It is deficient in the due proportion of fibrin, and in the power of coagulation; more especially it is incapable, even when wholly at rest, of forming a dense and firm coagulum. And, in consequence of such change in the fluid, there ensues an undue tendency to congestion of the capillaries. So that these vessels, when cut, are not only filled with blood incapable of affording the most important hemostatic means—coagulation; but also contain an amount of that fluid greater than in the state of health. The blood itself is probably altered in quality; but the nature of the change is not accurately known. Dissolution of the corpuscles or fibrin, so much insisted on by some writers, is not really present. The corpuscles seem to be deficient in numbers; and the liquor sanguinis is in excess; but these peculiarities may be the result, and not the cause, of the hemorrhage.

The capillaries and minute arterial twigs are also at fault. When examined, the latter seem to be devoïd of the middle coat; of a thin and feeble appearance, and unusually capacious. It may be that the middle coat is deficient, as some suppose; but more probably it exists, though in a defective state, and certainly much impaired in contractility and tone. In consequence, the other component parts of the natural hemostatics are equally defective as the power of coagulation (p. 306). The cut vessel contracts and retracts, scarcely if at all; remaining open and unshrunk, passively pouring out its thin contents. Further, the vascular coats are friable, and easily torn. Slight bruise produces serious ecchymosis; coughing may induce hæmoptysis; a sneeze brings on epistaxis; and extravasations are not unlikely to follow slight causes within internal cavities.

Thus, constituting the hemorrhagic diathesis, we have, besides general irritability of the circulation, blood flowing through dilated and non-contractile tubes, sent thither in greater volume than in ordinary and healthy circumstances, thinner and more fluent than in health, and little if at all able to arrest its own course by assuming the solid form; further, the containing vessels are prone to give way, on application of the slightest violence. Not unfrequently, a febrile condition at the same time exists; and when it does exist, it increases the intensity of the diathesis.

Treatment.—The history and appearance of a patient having made us aware of the presence of this morbid state of the general and circulating systems, every precaution will be adopted to prevent solution of continuity in any way—by wound, tear, or ulcer; more especially during early years. And at the same time, treatment will be adopted to oppose the diathesis and accomplish its removal. It resembles scrofula; and tonics, such as used in that disease, will be of service; patiently persevered with. It also resembles scurvy; citric acid is all-powerful in the one morbid state; it is likely not to be without its good effect in the other. Occasional, smart, purgative doses of sulphate of soda will prove beneficial, in two ways; as purgative and hydragogue, diminishing the amount of serum in the blood; as a chemical salt, seeming to have the effect of increasing the blood's power of firm coagulation.

In the crisis—wound and hemorrhage having occurred—our attention will be directed to the fulfilling of two indications: amendment of the state of the blood, and amendment of the state of the capillaries, with a view to hemostatic results. 1. We shall endeavor to increase the blood's power of coagulation; more especially its power of forming a dense coagulum. If possible, we would increase the proportion of fibrin. The induction of inflammation might effect this; and the attempt may be made at a distance from the bleeding part. The adventitious affection might prove useful in two ways: first, by increasing the proportion of fibrin, as all true inflammations do (p. 100); secondly, by having a derivative effect on the source of hemorrhage. But again, the excitement of the general circulation, apt to follow, will prove disadvantageous; and, besides, the propriety of wilfully inducing true inflammation in such a system may be seriously questioned. On the whole, this is a matter which can be determined only by the results of actual experiment; in which we are still deficient. Simple irritants, and dry cupping, however, seem certain to afford beneficial derivation, unalloyed with the chance of untoward casualty; and therefore may be unhesitatingly employed. There is no time by tonics and diet to [illegible]nister to the want of fibrin: that is the province of prophylaxis; [illegible] lingering cases, this indication will characterize our system of [illegible].

At first, we would give nothing in the shape of food or drink; being wishful to promote a state of nausea and depression, as favorable to the desired hemostatic result. But should our first effort fail, and the bleeding continue, as is not improbable, we would then administer nutritious yet non-stimulant food, in small quantities and frequently; as soup, animal jelly, &c. Avoiding aqueous fluids; plethora of thin blood being far from advantageous. Avoiding also wine, brandy, and all other stimuli, which would excite the circulation adversely to hemostatics; unless when driven to their use, at the eleventh hour, and in despair.

But though possessed of little power of contributing an increase to the amount of fibrin, we may endeavor to turn that which is already in the system to good account. Acetate of lead and opium favor coagulation, and calm the circulation; they are to be administered in full and sustained doses. The opium, besides, is supposed to have a tonic and astringent effect on the capillaries; and is specially useful, as already stated, in sustaining life under depression from loss of blood (p. 321). Should these medicines be found to disagree, they may be superseded by the sulphate of alum and potass, in doses of fifteen or twenty grains; or by gallic acid in doses of twelve grains frequently repeated; or by matico in infusion, as the stomach will bear.

Hydragogues, by diminishing the amount of serum in the blood, may contribute to its coagulability. Sulphate of soda, in purgative doses, will not only act in this way; but besides, as already stated, it seems chemically to favor the formation of a dense and firm coagulum. For chemical reasons, however, the sulphate of soda cannot be given in conjunction with the acetate of lead. Nutritive support, as already recommended, is essential; to counteract the debilitating effect of this and such like evacuating remedies.

Nauseant remedies not only moderate the heart's action, but plainly favor coagulation of the blood for hemostatic ends. Cautious and small doses of ipecacuanha or tartar emetic, so as not to produce actual emesis, are therefore expedient at the commencement of the case; artificially to induce the favorable state of depression, analogous to faintness from loss of blood, while as yet much waste of that important fluid has not occurred.

In conducting the treatment, one circumstance should never be forgotten; namely, that in this disease the chance of success diminishes with the duration of the bleeding; and that, therefore, the first few hours should be occupied by an especially zealous and sustained employment of the requisite means. After excessive loss of blood, the remainder of that fluid, originally poor in fibrin, becomes almost wholly defibrinized; and consequently but little hope of arrest by firm coagulation can then be entertained.

And another point should not be forgotten; namely, the propriety of not capriciously and rapidly shifting from one remedy to another, in haste and confusion; but coolly persevering in one well-selected plan, until a fair time has been afforded for this developing its full effect.

2. The second indication is directed to the state of the vessels. Of internal remedies, opium, we have already seen, is likely to exercise a beneficial influence in this respect. Topically, we have a large catalogue of styptics from which to make selection. In mucous surfaces, turpentine, gallic acid, matico, and the fluid nitrate of mercury, have often proved highly advantageous; and may be judiciously employed, as local adjuvants to the general means of arrest. But for general application, some prefer the nitrate of silver; not as a mere styptic, and trusted to alone; but as preliminary and adjuvant to what is to be considered the principal local means of arrest—pressure. The nitrate is used so as for a time to restrain the flow, and permit the apex of a graduated compress to be laid in a dry bed, in the manner formerly detailed (p. 311). And this compress is retained by bandaging, or otherwise, so as to exert a moderate and constant pressure on the source of the hemorrhage. A great amount of pressure must be carefully avoided; for both part and system are intolerant of this. Ecchymosis, sloughing, and ulceration, with much constitutional disturbance of a low and irritable type, will certainly follow; and in a short time blood will burst forth, from a wider surface, and with a more willing flow than before. Also, never let a soaked and oozing compress be trusted to; but let it be at once removed, and the dressing readjusted more accurately.

The actual cautery, enjoying a general reputation of being at once the most severe and most powerful of local hemostatics, has naturally been much employed in desperate cases; but invariably with an evil issue; as can, indeed, be readily understood. The slough or eschar which is formed arrests the flow for a time, while it is yet adherent (p. 316); but the process of detachment is, in such cases, both an early and a rapid one; and the ulceration, opening up parts devoid of plastic exudation, certainly reinduces the hemorrhage—and that too in an aggravated form. In the hemorrhagic diathesis, the actual cautery should never be employed. There is an intolerance of the remedy itself; and besides, the parts are by its use rendered incapable of bearing the subsequent application of pressure.

Deligation of the principal arterial trunk cannot but fail in such cases. The oozing is from capillaries; and their circulation, it is well known, will not be sufficiently affected by any such procedure.

Treatment having failed to arrest, and the condition of the patient having become almost hopeless, one effort may still be made for his life; by transfusion (p. 322). The operation should not be delayed until the patient is quite *in extremis;* let it be performed at a time sufficiently early to afford a reasonable prospect of success. One risk plainly attends its performance; namely, the making of an additional wound, which, in its turn, may assume an indomitable tendency to bleed. But experience has shown that such is not invariably the result.

Jones, on Hemorrhage, Lond. 1805; Guthrie, on Wounds, &c., Lond. 1815, and subsequently; Marshall Hall, Medical Essays, Lond. 1825 and 1830; Thierry, de la Torsion des Artères, Paris, 1829; Amussat, Archives Générales de Médecine, vol. xx. Aug. 1829; Velpeau, Gazette Médicale, vol. i, No. 48, Nov. 1830; Manec, Traité de la Ligature des Artères, Paris, 1832; Cyclop. of Pract. Med. Article Hemorrhage, 1833; Sanson, des Hemorrhagies Traumatiques, Paris, 1836; Sir Charles Bell, Essays, Edin. 1841; Hallet, Lancet 1177, p. 334; Author, Monthly Journal, vol. ii, p. 567.

DISEASE IN THE TISSUES.

CHAPTER X.

AFFECTIONS OF THE INTEGUMENT.

ERYTHEMA.

By this term is meant perverted vascular function, of a low grade, and tending to spread by continuity; occurring in the mere surface of the integument; chiefly resident in the *rete vasculosum cutis;* and seldom, if ever, rising beyond the stage of active congestion.

The *Symptoms* are heat, pain, and tingling in the part; a bright red blush; sometimes marked by an abrupt and distinct border, sometimes gradually lost by diffusion; more or less dryness, by interruption to normal exhalation; a very slight tumescence of the red surface, scarcely appreciable by the eye, yet capable of being distinctly felt by the finger lightly applied; increase in susceptibility of external impressions in general; and tenderness on pressure, which produces transient whiteness, with slight as well as temporary depression. These symptoms, having continued for a day or two, may simply decline; the part becoming gradually less swollen, red, tender, and painful, and resuming its wonted function. Numerous scales of cuticle become detached, and fall away; and the result is usually termed Resolution, by desquamation. Or, less frequently, vesication occurs; the vesicles forming slowly, and to no great extent; filled with a watery straw-colored serum; either simply drying, or bursting, and then crusting over; the uneasy feelings, thereafter, gradually subsiding; and desquamation again constituting the last part of the process of cure. The constitutional symptoms may precede or accompany. Sometimes they are sthenic, and of the inflammatory type; slight and transient; the consequence of the local disorder. Sometimes they are of the form of constitutional irritation; preceding rather than accompanying; and oftener the cause than the effect of the local ailment.

The *Cause* may be either local or constitutional; external or internal. Often it is external, and local; a puncture of the finger, for example, in dissecting, nursing, washing; probably with a state of system not ill-disposed towards the assumption of morbid change. The injured part es the inflammatory process; and this, instead of remaining of a bed character, spreads by continuity. The constitutional disorder is then of secondary occurrence; slight, of the inflammatory type, and soon passing away.

Or the cause may be internal and constitutional. The primæ viæ are sadly disordered; there is much bilious derangement, and serious febrile disturbance; during the progress of this febrile condition, an erythema breaks out on some part of the surface, spreading more or less; and, on its appearance, the general disorder undergoes a marked diminution. It is, as it were, an example of Nature's mode of relief, by counter-irritation and derivation. Or the patient is laboring under a low typhoid fever; and, during its progress, an erythema forms; sometimes with relief—though not so marked as in the former example; sometimes seeming rather to embarrass the [illegible]ll more, and increasing the tendency to prostration.

Treatment varies, according as [illegible]ema is reckoned the disease itself; or only a symptom of another [illegible]se, far more important. If the cause be local and external, with constitutional disorder slight and secondary, treatment is direct; as for the disease. The part is kept at rest, and fomented; or it is lightly pencilled over, either with a solution of iodine, or with the nitrate of silver. The latter, either solid or in solution, is probably the preferable application; seeking only the first effect; blackening and non-vesicant; simply antiphlogistic (p. 157). Antiphlogistic regimen is enjoined, a purge administered, and perhaps aconite or antimony. Resolution is obtained.

If, however, the cause be internal and constitutional, with the general symptoms formidable, and antecedent as well as concomitant, we seek no resolution. As small-pox and scarlatina have their eruptions, are relieved thereby, and become much aggravated by their repulsion; so fevers—simple, bilious, typhoid—sometimes have theirs; of an erythematous character. And the use of repellants is not more foolish in the one case than in the other. Our principal attention will be directed to the general disorder; contenting ourselves with palliation of that which is local (p. 20). Occasional fomentation relieves the unpleasant feelings in the part; and, at the same time, rather encourages derivation than otherwise.

When we are especially desirous that a spreading erythema shall be turned aside from certain parts, the nitrate of silver, still used lightly, is of service; not applied to the erythematous part, but in its vicinity; not as a resolutive, but as a limiting agent (p. 157).

ERYSIPELAS.

Erysipelas denotes the inflammatory process, resident in the superficial textures—skin, and subcutaneous areolar tissue; prone to spread, and tending to the true inflammatory crisis. According to its seat, cause, and general characters, the process exhibits marked variety in the symptoms and results; and various forms are in consequence enumerated. We shall treat of the Simple, Phlegmonous, Œdematous, Bilious, Erratic, and Periodic. The main division of the subject, however, is into the Simple and Phlegmonous. The others are but sub-variations

Simple or Cutaneous Erysipelas.

An inflammatory process pervades the entire true skin; and is more progressive than in erythema. The ordinary symptoms therefore, of such change, are more prominently developed. Redness is greater; often of a rosy hue; and hence the vulgar name of the disease. Swelling is greater; appreciable by both sight and touch. Heat and pain are of a burning kind, and often intense. Pale dimples, by compression, are more distinct, and less transient; though still soon passing away, by reflux both of circulating blood and of extravascular serous effusion.

At first, there is no actual tension; the swelling is slight, gradual, serous, and soft. Sometimes, however, when the process is especially acute—the case, perhaps, threatening to pass into the second form of the disease—swelling is fibrinous, considerable, and rapid; and more or less tension occurs. Ordinarily, as the moderate process steadily advances, serous effusion takes place superficially; elevating the cuticle by vesication—sometimes extensive and continuous, sometimes in the form of numerous small vesicles. On the cuticle giving way, spontaneously or by puncture, serous fluid escapes; usually with relief to the symptoms. But not unfrequently, similar effusion occurs on the internal, as well as on the external aspect of the cutis; serum is infiltrated into the subcutaneous areolar tissue, which though originally free, now becomes involved in the morbid process; and, if effusion be both copious and rapid, the swelling becomes tense as well as much increased, and the symptoms are aggravated thereby.

Very generally, a strong tendency is evinced by the mucous membranes of the respiratory and alimentary systems, to sympathize with the cutaneous surface. Not unfrequently, they seem to undergo, simultaneously, a somewhat similar affection; and this without metastasis.

Like erythema, erysipelas may simply resolve. Or vesication occurs; either alone, or along with gradual subcutaneous effusion. The vesicles burst, or are artificially emptied; the subcutaneous effusion is absorbed; the symptoms abate; and the part quickly regains its normal condition, by a process which may be still termed Resolution—by vesication. Such recovery is not always uniform and general. It may be partial, and successive; the part first attacked becoming first restored; while that more recently involved, in the line of extension, is yet in the nascent and acute stage.

Sometimes, however, the process does not recede, though vesication occur. The vesicle bursts, and the serum is discharged; but simple desiccation does not follow. A purulent discharge appears; the process having advanced to the grade of true inflammation. And not improbably, a similar formation may occur on the internal aspect as well; either at the same time or subsequently; causing subcutaneous abscess.

Such abscess only forms in the more intense, or neglected cases of simple erysipelas. It is neither early nor diffuse, as in the phlegmonous form; but surrounded by the usual fibrinous deposit, and consequently amenable to ordinary treatment. Should incision be delayed, however, sloughing of integument is not unlikely to follow; for the areolar tissue, having been previously infiltrated by acutely effused serum, readily yields before the suppuration, so far as the limiting fibrinous deposit permits; the skin is early undermined, and, being itself inflamed, with difficulty retains its vitality.

But suppuration, in simple erysipelas, is usually still more secondary. After the ordinary symptoms have satisfactorily subsided, and almost or altogether disappeared from the general surface affected, it is not uncommon to find, in those especially of feeble constitution, that inflammatory reaccession of a more intense and circumscribed character has occurred, either in some new or neighboring locality, or at one or more points of the part originally attacked (p. 203). In erysipelas of the face, for instance, the lower eyelids often thus suffer. The returned process is acute; the part, newl [illegible] fectly recovered from a previous inflammatory attack, is vit [illegible] in consequence, suppuration is early and copious; and, in the cou [illegible] o but a few hours, a considerable abscess may have formed. It is under such circumstances, that sloughing of the integument is most especially probable; if an evacuating incision be delayed.

The ordinary exciting *Cause* of simple erysipelas is external injury; often slight; applied during a disordered state of system, favorable to inflammatory accession. In most cases, therefore, constitutional symptoms may be said to precede the local. But the antecedents are not inflammatory; they are either simply febrile, or, more frequently, those of stomachic and biliary derangement; foul tongue, bitter taste in the mouth, headache, tendency to shiver, thick turbid urine, sickness, and bilious vomiting, &c. On occurrence of the local change, the general disorder, as usual, assumes more or less of the inflammatory type; then gradually subsiding, according as the local disease and its constitutional predisposing cause yield to suitable treatment. When the former is comparatively slight, the antecedent constitutional disorder is often relieved by its appearance; and can scarcely be said, at all, to acquire the inflammatory type.

In some few cases, the cause would seem to be chiefly local. Then there are no precursory general symptoms; the constitutional disorder is secondary, and of the ordinary inflammatory character. The light and gentle modern treatment of wounds, being opposed to inflammatory accession, is beneficial; not only in favoring speedy reunion, but also by avoiding the risk of erysipelas.

Often, the state of the atmosphere seems to exert a powerfully predisposing influence in favor of the accession of this disease. And, hence, we not unfrequently find it assuming an epidemic form during spring and autumn; when atmospheric vicissitudes most prevail. When such is the case, we also find the constitutional symptoms, whether primary or secondary, tending to show very plainly the asthenic character; the more especially as the majority of those attacked are of already weakened frames, by dissipation, poverty, or previous disease.

Habitual exposure to heat, as in cooks, and furnace-men, predisposes to erysipelas; by occasioning frequent sanguineous determination to the surface. And frequent irritation of the skin, by friction or otherwise, has a similar effect; as in sailors, by the rubbing of hard canvas trousers, often saturated with the briny element of their vocation. Exposure to cold, by its reactive effect, may predispose to erysipelas; in those parts chiefly implicated—the hands and face; as in coachmen. But it is to be remembered, that in such cases, as well as in those of habitual exposure to heat, other causes may be in operation; especially in the lower ranks; namely, habits of intemperance.

When erysipelas has once occurred, both part and patient remain liable to its return, from the application of a comparatively slight cause; and are to be guarded accordingly. Many persons, particularly females, are the subjects of regular periodical attacks; usually slight. And, though very amenable to the usual treatment, these are not to be rashly interfered with; their occurrence and ordinary course seeming to be a natural relief from more serious impending disorder of the system.

Prognosis varies, according to circumstances. The more extensive the erysipelas, the more grave are the constitutional symptoms, and the more serious is the case. If situate on the face, head, trunk, or genitals, it is more dangerous than on the extremities. If constitutional symptoms are both antecedent and concomitant, and of a marked asthenic type, the case is one of danger. In early childhood and advanced age, when the balance of life is very delicate, and easily turned, erysipelas may operate much to the patient's disadvantage, and even terminate fatally. Previous habits of intemperance, atmospheric influence of a sinister kind, and exhaustion by former disease, engender intolerance of erysipelas, even when apparently slight; and cloud the prospect of speedy and satisfactory cure.

Treatment.—This must not be of the abortive or ectrotic character; whether the disease be of local or constitutional origin. If the former, sudden arrest is apt to be followed by speedy reappearance of the inflammatory process in another part; it may be in the integument, or it may be in the lining membrane of an important internal cavity. Metastasis occurs, and often unfavorably. If the latter, natural relief to an oppressed system is thwarted; and constitutional disorder is not only not relieved, as it should have been, but becomes perhaps seriously aggravated. Treatment, then, will not consist of direct repellents; but of such local means as favor gradual resolution; invariably accompanied, and if possible preceded, by search for and removal of the apparent cause.

In most cases, as already stated, the predisposing cause is derangement of the primæ viæ. If an emetic be not otherwise contra-indicated, it is an excellent commencement of practice; unloading the stomach, promoting the flow of bile, and usually inducing profuse perspiration from the general surface. It is followed by a purge, usually of a mercurial kind—say calomel and jalap; performing the same good office for the bowels which the emetic has done for the stomach. The antiphlogistic regimen is enjoined; and if the constitutional symptoms be sthenic and inflammatory, antimony may be exhibited moderately. In general, however, antimonials will be well superseded by aconite and belladonna, in simple aqueous solution; given alternately, and in small doses. If secretion in general, but more especially from the intestinal canal, threaten to remain of a vitiated character, the list of alteratives is applied to. And, of these, the *hydrargyrum c. cretâ* may be mentioned, as especially useful; in overcoming the obstinately dry tongue, arid skin, confined bowels, and scanty urine, with other signs of diminished secretion, which are very commonly found after subsidence of the acute stage of the disorder.

Local applications consist of warm fomentations, whereby the ordinary antiphlogistic results are obtained. The vulgar prejudice which at one time existed against "wetting the rose," has long since subsided. One mode of wetting is indeed highly prejudicial; that is, by cold repellent lotions; more especially when the disease is so situated—on the head, face, or trunk—as to render metastasis not only probable, but certain to prove most untoward [illegible] occur.

When tenderness, heat, and [illegible] surface are especially great, fomentation may be beneficially [illegible] as by acetate of lead and opium, in weak solution. In the slighter [illegible]ses, a comfortable sensation follows dusting the part thickly over by a light and fine powder—as flour, or magnesia; probably on account of the stimulus by atmospheric influence being thus removed. But, in most cases, it is better to dispense with such an envelope; considering it to be of much higher importance to maintain a constant and complete surveillance of the varying condition of the part.

To minor examples, the simply antiphlogistic use of nitrate of silver is applicable. But it, too, is objectionable, on the score of concealing the true state of the part. And besides, it sometimes seems to have the effect of, as it were, driving the disease from the skin to the subjacent areolar tissue, and so favoring suppuration; as if inducing metastasis from the superficial to the deeper strata, and concentration there. We may avail ourselves of its circumscribing power, in any case; as in erythema. But its direct employment we would consider applicable chiefly to erythema; and, in erysipelas, to the minor cases only; namely those which, besides having little intensity, are of limited extent, and situate on the extremities. When employed, it is used in the form of strong solution, laid freely on; so as not only to cover every part of the erysipelatous surface, but also to include a border of sound skin, to the extent of two or more inches around. And as the disease spreads, the application should keep pace with it, by renewal. My own experience of this remedy forbids its direct use in all cases of erysipelas affecting the head or face; and, as already stated, while limiting it to the minor forms of the disease everywhere, finds a special favor for it when this disease affects the extremities.

Some, seeing the relief which ordinarily attends on spontaneous vesication, have thought of imitating this; by direct use of the nitrate of silver, somewhat intensely applied. The result of this additional stimulus to a part already being inflamed, however, is more likely to aggravate than to subdue the disease.

Whenever erysipelas is from the first acute, and obviously progressive, local bloodletting is advisable; unless plainly contra-indicated by constitutional peculiarity. For this purpose, leeches are often employed. But they are apt to do more harm, by the stimulus of the wounds, than good by the abstraction of blood. Their suction seems to be inimical to adhesion, and favorable to inflammation and ulceration, even in a previously uninflamed part. Punctures, rapidly made with the point of a lancet, are preferable. They may be more painful at the time, but the smarting soon ceases; the inflammatory process soon declining, they usually heal by adhesion; and, on subsidence of swelling, the cicatrices are so minute and faint, as to be almost or wholly invisible. They are more efficient, as antiphlogistics, than leeches; less apt to irritate; and seldom if ever leave any mark at all approaching to deformity. They fulfil a twofold indication; abstraction of blood, and evacuation of inflammatory effusion. The majority are made to implicate only the *rete vasculosum;* their object being loss of blood. A few—and only a few such are necessary, the spaces of the areolar tissue freely communicating—penetrate more deeply to the subjacent tissue; their object being to drain off the serous effusion; so favoring vascular relief, and at the same time preventing the occurrence of untoward tension. Hot fomentation is assiduously employed, for some time after infliction of the wounds; being favorable to both indications. And if the sanguineous flow be not altogether satisfactory, it may be increased; by the temporary application of a ligature, on the cardiac aspect of the part.

This practice, by puncture, may startle those who are practically unacquainted with it; by its apparent severity. But the severity is only ideal. We grant that, in one point, the infliction of temporary pain, it may be more severe than leeching; but in every other, it is much and truly superior. Alarming it may be, to the timid patient; but it is quickly over. A few seconds suffice; and the relief is both satisfactory and instant. In the more severe cases which demands its use, the pain of infliction is often the least. The acute pain, already existing in the part, masks that of the punctures; in the same way as the operation of scarifying tense and painful gums seems, not unfrequently, to be agreeable rather than otherwise to the teething child. And, as already stated, the ultimate cicatrix of each puncture is so trifling, as to render the practice equally applicable to the face, when erysipelatous, as to any other part of the surface.

During treatment, the erysipelatous part should be retained in an elevated posture, for obvious reasons; when that is practicable.

When abscess forms, whether during acute progress of the disease, or of secondary occurrence, an early opening is highly advisable; to save both skin and areolar tissue. For although the abscess be not diffuse, but may be somewhat limited by fibrinous exudation, yet its tendency to rapid extension is greater than in ordinary circumstances. The affection is, more or less, asthenic (p. 134).

So soon as the disease has begun to subside, there is often a necessity not only for discontinuance of general antiphlogistics, but for recourse to tonics and support of the system; as in the old, or in those of previously debilitated frame, and when the affection is of an epidemic character. Wine is given, at first cautiously; with as much plain nutritious food, as the stomach can easily digest. And be it remembered, that such tonic general treatment is, in such cases, not incompatible with continuance or resumption of local antiphlogistics; should these be demanded by the state of the part.

Not unfrequently, wine must be given from the first; along with, perhaps, local bloodletting and other antiphlogistics. In no other way may old or otherwise worn-out frames make head against the asthenic constitutional symptoms, which sometimes not only accompany but precede the Erysipelas. To save texture, and arrest disease, it may be necessary to puncture and poultice; while, to maintain life, it is at the same time essential to administer stimulants internally. On reflection, the practice will not be found so paradoxical as it may at first seem.

In all cases, after the inflammatory process has passed away, gentle and uniform support by bandaging is expedient; preventing congestion, removing the tendency to œdema, and hastening restoration to the normal sthenic condition. But this, [illegible]her tonic treatment, whether local or general, must be both ca[illegible] begun and cautiously maintained; being apt, if carelessly conducted, to prove excessive, and induce secondary suppuration.

Mercurial inunction of the erysipelatous part has been loudly advocated. We are averse to all concealment of an inflamed part; and, besides, would dread an undue stimulus from the mercurial, in the early stage of the disease. By Velpeau, sulphate of iron is lauded as a local application; either in solution, an ounce to the pint of water; or as ointment, a drachm to the ounce of lard. Pressure is also a favorite continental remedy; from the first, and however acute the process. When gentle and uniform, it is very useful after subsidence; but, until then, however carefully employed, it is more likely to aggravate than to assuage.

Of late, a special remedy has been proposed in erysipelas, somewhat on empirical principles; iron. The most common form is tincture of the muriate; administered in doses of 20 or 30 drops, in the adult, every two or three or four hours. Many incontrovertible facts are being contributed in favor of this remedy; and the experience of both surgery and medicine bids fair to establish it as a powerful opponent of asthenic inflammation.[1]

Phlegmonous Erysipelas.

This is an infinitely more serious affection. The inflammatory process is intense, and rapid in its progress; and a plurality of tissues are involved from the first. The skin and areolar tissue are both acutely inflamed; liquor sanguinis is profusely exuded, and tension ensues; swelling is great and rapid; a limb, not unfrequently, is enlarged to twice its normal girth; the skin is red, hot, tight, and shining—showing no rugæ, but smooth and glistening; pressure is very painful, and the part feels as if converted into brawn. Vesication often takes place, in a broad extended form; as in the first effect of a blister. It is rather a favorable sign, than otherwise; for sometimes it betokens a subsidence of disease. But, usually, as the part grows tense, the morbid process is further increased; and, unless speedy relief arrive, suppuration occurs. Inflammation is asthenic. The pus is ill concocted—not laudable, but thin and ichorous; the parts are not protected by any plastic exudation, but open and defenceless; infiltration takes place, rapidly and extensively; areolar tissue is broken up, ulcerates, and sloughs; skin is undermined, and sloughs also. The system sympathizes largely. At first, inflammatory fever exists; often intense. But, on the occurrence of destructive infiltration, a change is made to the form of constitutional irritation; of a still more alarming character; probably first showing the type of irritative fever; then that of hectic, ultimately that of prostration and collapse (pp. 127, 134, and 201).

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[1] *Vide* Bell, Edinburgh Monthly Journal, June, 1851.

But the disorder and its effects are by no means limited to the textures primarily involved. Suppose the case to be both intense and neglected. Inflammation spreads, by contiguity as well as continuity; and that rapidly. Fascia is involved, and subfascial areolar tissue. The tension which results from this, is greater and more serious than from merely subcutaneous infiltration; and the disease is proportionally aggravated. Intermuscular tissue is implicated, and muscles are detached by its disruption; periosteum inflames, and suppuration—still diffuse—takes place beneath it; bone inflames and dies; joints are opened into, inflame, and suppurate. Inflammation, diffuse suppuration, and sloughing, having at length more or less involved almost every texture of the limb, the suffering frame may demand amputation to save life; or death may ensue, ere ever an opportunity for operation occur. Such fatal issues are not unfrequent; but still more common are stiff joints, necrosed or carious bones, withered limbs, and wasted frames—the results of ill-treated phlegmonous erysipelas.

The constitutional symptoms which may attend on this grave malady are of three kinds. 1. Of a bilious character, as in most examples of the simple form; preceding, and ushering in local disorder. 2. Inflammatory fever, during the rise and progress of the inflammatory process. 3. Constitutional irritation; suppuration having formed, and, by infiltration, advancing rapidly in its devastating progress.

The causes are similar to those of the simple form. And, in but few cases, will the predisposing cause of sinister atmospheric influence be found wanting.

Treatment.—This, in the first instance, must be mainly constitutional, as in the simple form. Emetic, purge, antiphlogistic regimen, and perhaps venesection. Were our object simply to overcome an intense inflammatory process, hastening on to dire results, we should bleed always. But we know that, in most cases, the asthenic stage is both early and serious—more especially when the disease is of an epidemic character; and that, in all cases, if inflammation be not arrested in its very rise, suppuration and infiltration are inevitable, and certainly followed by constitutional symptoms tending to the lowest type. Only at the very commencement of the case, then—in patients previously robust, and when the symptoms hitherto have indicated somewhat at least of the sthenic character—is the highest antiphlogistic remedy, general bleeding, advisable. And even in those cases in which it is expedient, it must be practised with a cautious economy of the "liquid living flesh;" for, as in compound fracture and other severe injuries followed by inflammation, however acute and apparently sthenic the action may be at first, a long day of trial to the system, by debilitating causes, may be fast and surely impending.

In very many cases, our aid is not demanded until the period for active general treatment has arrived; and then local bleeding, which is essential, can be made to have a constitutional effect. In almost all cases, the aconite and belladonna will be found useful, as in the simple form (p. 337).

The affected part is placed at rest, elevated, and with its muscles relaxed. At first, the most suitable application is hot fomentation; and under this, with appropriate constitutional treatment, the case may resolve. More commonly, however, inflammation advances; swelling rapidly increases, and tension with aggravation of pain ensues; liquor sanguinis—not serum, or serum principally, as in the simple form—has been exuded. If the process advances ther, the deposit will rapidly degenerate into an ill-conditioned pus, ich will be widely infiltrated into the defenceless texture around; the areolar tissue is doomed, the existence of the integument has grown precarious, and constitutional disaster is inevitable. This, then, is the period for action; a period both early and brief. The exudation must be permitted to escape; and loss of blood, copious and direct, is necessary to arrest the advancing process. Punctures evacuate serum readily enough; and the loss of blood which they occasion is sufficient to allay an inflammatory process of no great intensity. They are, consequently, very suitable in simple erysipelas; but, for the phlegmonous form, they are altogether insufficient. Here punctures are superseded by incisions; the lancet by the scalpel or bistoury. Through the incision, liquor sanguinis drains away; ere yet it has degenerated, or while it has just begun to do so. Blood is drawn rapidly, and in sufficient quantity to arrest the local disease; at once limiting further deposit, and preventing degeneration of this under inflammation. And the exudation, comparatively slight, which does continue, has no opportunity to infiltrate; but at once finds a ready access to escape.

This is the true time for incision. Saving disruption and sloughing of areolar tissue, danger to skin, and serious disorder of system; while the process is yet comparatively recent, and just in the act, as it were, of surmounting its true inflammatory crisis; when the part is tense, red, shining, painful, throbbing, and feels like brawn. At a subsequent period, when suppuration has occurred, and deadly infiltration of purulent fluid begun, incision is demanded; with equal, or even greater urgency. But its object is wholly different. Too late to save tissue, and prevent disaster; in time only to mitigate, and perhaps limit, destruction already done. The knife, when used at the proper time, need not go deeper than the subcutaneous areolar tissue; the process and its results having, as yet, extended no further. But, when used at a later period—too late to prevent mischief, and only in time to limit—it must generally perforate the subjacent fascia as well. In fact, it must reach all the infiltrated textures; otherwise it might almost as well be wholly omitted. This, therefore, is another argument in favor of early incision.

The treatment of phlegmonous erysipelas by incision may be said to be as old as the surgery of the 16th century, according to Prospero Alpini; or it may be taken even as far back as Oribasius, A.D. 350. But its true introduction into practice is comparatively recent; by the exertions of Mr. Copland Hutchison and others. It seems a severe remedy; and doubtless so it is. But it seems more cruel than it really is. The wound looks both wide and deep at the moment of infliction; but, in a few days, sometimes after but a few hours, subsidence of the swelling may have reduced it to a comparative scratch. And, besides, even though it were altogether as severe as it seems, no other proceeding will prove equally efficacious; and "*ad extremos morbos, extrema remedia.*" There can be hardly any question as to the propriety of free incision, after suppuration has occurred; for there is no other means of sparing both part and system. Some are not fully persuaded of the justice and expediency of the practice, at the earlier period; when infiltration is only of liquor sanguinis, and when inflammation has not yet reached its crisis. But we think that due consideration of the indications which such treatment comprises, and of the paramount importance of fulfilling such indications, is not unlikely to reconcile all sceptics to the seeming cruelty.

At one time, also, it was matter of dispute, among those who favored the practice of incision, whether the wounds should be long or short. Whether the knife should be entered at the upper part of the inflamed texture, and carried down continuously throughout its whole extent, however great that may be. Or whether it should be applied only to those parts most implicated, where tension and pain are greatest, and infiltration and suppuration most imminent. Seldom, if ever, is the whole part equally affected. Some points of the surface—perhaps the greater number—may show only the characters of simple erysipelas, or little more; while in others the phlegmonous signs are in active progress. By the latter only are incisions demanded. Consequently, we find that common sense and common practice have decided in favor of the "short cut" system; and no longer, as has been well observed by Professor Cooper, are yard-measures required for ascertaining the extent of incisions in erysipelas. To enter a knife over the great trochanter, and withdraw it only when it has reached the knee, or not until even the outer ankle has been approached—as has been done—is to inflict a very serious wound. Much loss of blood, shock to the system, and protracted suppuration must follow. And this triumvirate, becoming associated with the exhausting effects of the natural progress of the disease, is not unlikely to overpower the system. A few small wounds, implicating only those portions of the texture where their presence is essential, are not only much less serious as an additional mechanical injury, but more effectual as a remedy.

The hemorrhage is direct and copious; and is permitted to continue, until enough shall have flowed for satisfactory evacuation of the part. And, as formerly stated, in many cases the loss is carried a step further; so as, at the same time, to afford a sedative result upon the system. Should the flow threaten to prove excessive, the part is elevated; and pressure is temporarily applied, on the bleeding point or points, either by the finger, or by lint and bandage. It is very seldom that any vessel is wounded of sufficient size, or activity, to require a ligature. In some cases, when we have hazardous inflammation, with much impairment of general power, we are constrained to incise, and yet are very loath to shed blood. In such circumstances, the wound will be as limited as possible, in both extent and depth; and temporary pressure, with elevation of the part, will be had recourse to, almost immediately after the incising.

After bleeding has ceased, pressure—if employed—is withdrawn; and fomentation resumed. During the intervals of fomentation, a light warm poultice is applied to the inflamed surface; favoring extra-vascular exudation—which is now harmless, because readily escaping so soon as formed; and expediting subsidence of the inflammation. The wound itself inflames and suppurates; and, not unfrequently, a thin ash-colored slough coats its margins. But the surrounding areolar tissue retains its integrity; its abnormal liquid contents gradually exude; swelling falls rapidly; redness, pain, and tension all disappear. This resolutive process will be found far advanced, in the course of two or three days; and then both fomentation and poultice, but especially the latter, are to be discontinued. To employ them longer, would be to render certain the occurrence of those untoward relaxing and suppurative results, formerly stated (p. 190). Fomentation is altogether laid aside; and, instead of poultice to the whole surface, tepid water-dressing is applied merely to the wound or wounds; changed as often as the discharge—at first usually profuse—renders necessary, on the score of cleanliness.

To the general surface, early support by uniform bandaging is expedient; for like reasons as in the simple form, but more urgently demanded. At first, let the application be especially gentle; otherwise the stimulus of pressure, coming with the support, may reinduce inflammation. And in those cases in which suppuration has occurred, areolar tissue has sloughed, and skin has been to some extent undermined, caution in bandaging is most necessary, throughout; otherwise injury may be done to vessels more or less isolated by the destruction which has raged in the common textures around. At the same time that local support becomes expedient, so does support of the system. And in many cases of the phlegmonous, as of simple erysipelas, a general tonic system of treatment is required at an earlier period; while, locally, antiphlogistics are still in use; general support and local depletion being by no means incompatible (p. 340).

The wounds, on subsidence of general swelling, shrink greatly in their dimensions; and as both part and system recover tone, discharge is diminished, and healthy granulation advances. During separation of the superficial sloughs, water-dressing is applied. After separation, this is more or less medicated; as the character of the granulations may seem to require. Not unfrequently, there is a tendency to exuberance of granulation; delaying the cure, and producing an unseemly bulging cicatrix, when that is at length obtained. This is best obviated by early adoption, and due maintenance, of well-arranged pressure (p. 211).

There is the same necessity for guarding against the occurrence of secondary abscess, as in the simple form.

If iron be given as a special anti-erysipelatous agent, it will be best placed, probably, after the brunt of the inflammation has been subdued by the other means. In this form of the disease, when fully developed, no special treatment, we fear, will supersede the necessity of free antiphlogistic use of the knife.

Phlegmonous erysipelas has been thought contagious. On this subject, however, opinion is found greatly to vary. And, during the unsettled state of the theoretical question, it is well to keep on the safe side in practice; by treating the disease, especially in hospital, with every precaution against communication.

Not unfrequently, it is complicated with other maladies; also of a serious nature. Phlebitis and inflammation of the lymphatics own the same predisposing and exciting causes; the predisposing being constitutional disorder of a gastric character, sinister atmospheric influence, or both; the exciting—wounds, and other mechanical injuries, more especially when treated unskilfully.

Œdematous Erysipelas.

This is a low grade of the inflammatory process, in a weak system; and the same textures are involved as in the phlegmonous form. True inflammation is not reached; and the characteristic effusion is that of serum, in subcutaneous areolar tissue. Swelling is great, but gradual; soft; and pitting, deeply and durably, on pressure. There is no tension, and little heat or pain; itching, rather, is complained of, and the redness is of a pale hue. The extremities, especially the lower, are the parts most frequently affected. Constitutional symptoms are but slight. There is obvious derangement of health; more of the asthenic, than of the sthenic character; yet scarcely referable to any peculiar type.

Treatment.—Punctures are advisable; but they need be few in number. For, slight loss of blood will suffice to moderate the inflammatory process; and not many apertures are necessary for effectually draining off the serum. For a day, or so, fomentation is employed; and then uniform bandaging is had recourse to—at an earlier period, and more perseveringly maintained, than in any other form of erysipelas. There is little risk of reinducing the inflammatory process; and stimulation of absorption is the paramount indication. At the same time, diuretics will probably be expedient; as in other examples of serous accumulation. General disorder of secretion may require alteratives. Withal, a tonic system of treatment is to be maintained; and sometimes it requires to be rather actively pursued. The iron treatment seems specially indicated.

Bilious Erysipelas.

This term is applied to those cases of Erysipelas, in which the symptoms of biliary derangement not only precede local change, in a marked form; but are, throughout the whole progress of the case, of a very prominent character. Either simple or phlegmonous erysipelas may be so characterized; but the former by far the more frequently. In truth, the local disease is usually slight; seldom reaching suppuration; and the constitutional symptoms also partake in but a slight degree of the inflammatory type. The more prominent general symptoms are;—headache, nausea, bilious vomiting, pain or weight at the epigastrium, thirst, loathing of food, eyes and face suffused, general hue yellow, sclerotics especially discolored, foul dry tongue, and a bitter taste in the mouth, bowels constipated, urine scanty, and depositing a copious turbid sediment. Locally, the ordinary signs of the inflammatory process are but slight; and redness is almost merged in the prevailing yellow discoloration of the integument.

Treatment will be mainly of the constitutional kind; emetics, purgatives, alteratives, diuretics, and diaphoretics, as circumstances require; and on these the practitioner is mainly to rely, for cure of the local as well as of the general symptoms. Treatment of the part is but a secondary matter, and is gentle, in proportion to the disease for which it is demanded; fomentation, rest, bandaging; seldom abstraction of blood.

Erratic Erysipelas.

The peculiarity of this form is its tendency to shift from one part to another. Not extending merely, and occupying a larger space, as simple erysipelas dose; nor leaving one part suddenly, to reappear at another, somewhat distant; as any form of the disease may do. But leaving one part, for another; and yet maintaining the extension continuous and unbroken. The inflammatory process is invariably slight; often little more than a mere erythema. Its occurrence is, almost uniformly, indicative of a feeble and impaired system. The constitutional symptoms are always antecedent, as well as attendant; of the asthenic kind; and, if not actually typhoid, tending manifestly to that type.

Treatment, accordingly, has little to do with the affected part. Fomentation and rest suffice. And if the spreading be in an unfavorable direction, as towards the face or scalp, it may be diverted into another course; by the use of nitrate of silver, as a limiting agent (p. 157). The system mainly occupies our regard. Alteratives, tonics, stimuli, are given as required. When sinking has fairly threatened, turpentine, given by both mouth and rectum, will be found an excellent remedy, in addition to the ordinary means of support.

Periodic Erysipelas.

By this term is understood a form of the disease, characterized by frequency, and sometimes by accuracy, of return; either reverting always to the same part; or selecting a variety of parts for its seizure. Sometimes the season of the year, sometimes the occurrence of menstrual function, seems to determine the period of return. The amount of vascular disorder is usually slight, and the swelling almost entirely serous.

During the attack, local treatment need be but gentle. Our object is not to cut short the disease, but only to smooth its course; and the safety of texture demands no energy of interference. Repellents are especially reprehensible.

It is during the intervals of attack, and when invasion is expected—either from return of the ordinary time, or the appearance of premonitory symptoms—that treatment will prove most useful; directed towards removing that abnormal state of system, whether constant or periodic, which the erysipelatous affection mainly depends. Here, again, iron of much service.

Hospital Erysipelas.

This term is often applied to the disease, in all its forms, as occurring hospital practice; the patient not being admitted while laboring nder the affection; but having been seized by it, while resident within he institution on account of other ailments. The phlegmonous form is sually most frequent, under such circumstances. And if the cases prove numerous, either the disease will be found at the same time prevaent out of doors—untoward atmospheric influence conspiring thereto; r some serious fault will be apparent in the hospital management, as egards ventilation, dressing of sores, and bestowal and arrangement of patients. The chief peculiarity of hospital erysipelas is that an especially asthenic type prevails, even in the most urgent cases; and that, consequently, as a general practice, energetic spoliative and depressing antiphlogistics are not advisable in the treatment.

Our attention is to be chiefly directed towards prophylaxis. The number of patients, in one ward, should be few; and those with foul running sores should be carefully segregated. Sores should be dressed lightly, and simply; avoiding all stimulating, acrid applications; lest undue excitement follow, and the spreading or erysipelatous character supervene. No sponges should be permitted to appear within the wards; and every possible means should be taken, to avoid community of dressing, and contamination of sores. Dressing is to be renewed, as often as cleanliness demands. Not unnecessarily; lest the sore resent, and inflame. Not too seldom; otherwise pus accumulates and putrefies; not only irritating the sore and its vicinity, but polluting the whole atmosphere of the ward, and injuring all its occupants. Ventilation, and general cleanliness of the apartments are most essential. And, as formerly stated, it is well to use all precautions, as if the disease were undoubtedly contagious.

General Characters of Erysipelas.

Thus, then, we find the general characteristics of the erysipelatous inflammatory process, in its more marked forms, to be: Tendency to spread; tendency to change its site by metastasis; tendency to prevail in an epidemic form; deficiency of concomitant fibrinous and plastic exudation; rapid attainment of the suppurative crisis. The pus, as if imperfectly concocted, thin, and non-laudable; by its diffusion, danger to texture great. In the constitutional symptoms, the inflammatory type seldom predominant; tendency to the asthenic character usually strong, often even from the first; gastric and biliary disorder, with general derangement of secretion, primary and great. Active local treatment not advisable, when texture is not in danger; but, when diffuse suppuration is either threatened or established, free incision alone remedial. Active constitutional antiphlogistics in few cases well borne; unnecessary, except in the most sthenic and intense examples; and, even then, to be employed with much prudence and moderation. In the majority of cases, and at a comparatively early period in all, constitutional support, on the contrary, demanded. In short, an asthenia, or tendency thereto, reigns throughout. And by some this is accounted for, by supposing a poisonous influence to be exerted on the system; either generated within, during and by the inflammatory process; or conveyed from without, by atmospheric influence, or by direct contagion.

In addition to the general references under Inflammation, see Wells, Observations on Erysipelas (Trans. Med. and Chir. ii), Lond. 1800; Hutchison, on the Treatment of Erysipelas by Incision (Med. Chir. Trans. v), Lond. 1814; Duncan, cases of Diffuse Inflammation (Ed. Med. Chir. Trans. vol. i), Edin. 1824; Higginbottom, Essay on the Use of Nitrate of Silver in Inflammation, Lond. 1826; Lawrence, on the Nature and Treatment of Erysipelas (Med. Chir. Trans. xiv), Lond. 1828; Cyclop. of Pract. Med. Article Erysipelas, 1833; Dupuytren, Du Phlegmon Diffus, [illegible]s, tom. ii, p. 289; Dobson, on the Treatment of Erysipelas by Punctures, M[illegible]. vol. xiv, p. 206; Fenger, de Erysipelate Ambulanti, Haoniae, 1842; Bell, [illegible]ron in Erysipelas, Monthly Journal, June, 1851.

HOSPITAL GANGRENE OR HOSPITAL SORE.

This was, at one time, a scourge of hospitals, both in civil and in military practice; especially in the latter. But since both the treatment of sores and management of hospitals have much improved of late, it is of comparatively rare occurrence. And, when it does appear, it seldom evinces those formidable and intractable characters, which formerly used to carry devastation and death.

It seems to have been known and described by the old writers, as Œtius, Paulus, and Avicenna; but was not noticed, prominently and distinctly, till during the late wars; in the end of the last century, and beginning of the present. Then, from the crowding of wounded men, in hot, dirty, and confined apartments, perhaps after long and rough carriage, with bad food, mental depression, and insufficient attention to dressing and cleanliness—foul degeneration of sores became not uncommon. And Hospital gangrene came forth in all its virulence; as the graphic pages of Hennen, Blackadder, and Boggie, sufficiently testify.

Within these few years, it has made its appearance in the Surgical Hospital of this city; in a slight form. In truth, we believe that few Hospitals grow *old* without contracting a tendency to the generation of this trouble, more or less. With us, temporary removal of the patients, with thorough cleansing of the wards, has always sufficed for its arrest.

The disease is an example of Sloughing Phagedena (p. 227.) It may be produced by direct contact; or, more indirectly, by infection. Or it may occur independently of either; from crowding, evil dressing, or noxious atmospheric influence. Mercurialism is especially favorable to its accession. It may either seize on a wound already existing, or appear in a part previously entire.

On an unbroken surface, the first appearance is usually either a pustule or vesicle; small, dark, and accompanied with sharp stinging pain. On giving way of the cuticle, a slough is formed, and this continues to extend, in both surface and depth. After a time, the slough begins to separate; but without arrest of destruction in the part; this being continued by acute phagedena, often with greater and more unremitting pain than before. Then sloughing appears. And so the work of local death advances; invariably accompanied with profuse, fetid, and thin discharge. Sometimes the progress is so rapid, as to cover a large space within a few hours; in other cases, the advance is reckoned more conveniently by days than hours. The ulcerous cavity is generally of a circular form; as if scooped out by an instrument. The edges are jagged, everted, and well defined; often studded with red points, of a peculiar appearance, said to be characteristic of the disease. The lymphatic glands are apt to become affected, at an early period; they enlarge, suppurate, and open; and the ulcer is prone to assume the same action as the original sore. The surrounding parts are swollen, red, tense, painful, and of a dark livid hue. And this inflammation is apt not to remain limited, as a mere antecedent to local death; but to spread, adding the serious complication of erysipelas to the original malady. And, thus, hospital-erysipelas and hospital-sore may be found to coexist.

When a wound is attacked—as is most frequently the mode of accession—it first inflames; and pain is severe; the patient complaining as if wounded there by an insect. Discharge is diminished; or may be, for a time, altogether arrested. Then the granulating surface rapidly changes, assuming a dirty white color; and sometimes becoming spongily elevated and crepitant, by air, the product of putrescence. The surrounding skin swells, and is of a purplish hue. Slough forms; either in one continuous mass, or in detached portions. The dead matter begins to separate, but not by a healthy process; the edges harden, become everted, remain of a dirty white appearance, and pour out much fetid discharge—very different from the healthy pus which escaped but a few hours before. Sometimes the body of the sore has not the gray or whitish color, which usually obtains; but is dark from the beginning, the sloughing parts being infiltrated and mixed up with putrid extravasation. The degeneration generally commences at the edges, but rapidly invests the whole; and the continuance of the malady is also chiefly marginal.

The constitutional symptoms, in whatever way the local affection may have made its attack, are invariably formidable—constitutional irritation, typhoid fever, and tendency to collapse. As in erysipelas, they sometimes precede and usher in the local change; sometimes they are only consecutive and attendant. When antecedent, they are always aggravated by the occurrence and extension of the local disorder; an event not invariable in erysipelas. In some very few cases, when the patient was just before robust and in rude health, and has suffered by direct contagion, the introductory constitutional symptoms may be of the inflammatory type; but, even then, these will be very transient, and soon become merged in irritation. More frequently, the commencement is with irritative fever; this glides into the confirmed typhoid, and sinking follows.

Along with corporeal depression comes mental despondency—"The bravest soldier betrayed a symptom which, in those of less strength of mind, formed a striking feature in every stage of the disease; namely, the greatest imaginable impatience of pain, and depression of spirits.

Those who had borne amputation without a groan, shrunk at the washing of their sores, and shuddered at the sight of a dead comrade, or even on hearing the report of his death; instantly predicting their own dissolution, and sinking into sullen despair."[1]

No texture is proof against the ravages of this disease. The arterial resists longest, but in the end gives way; and hemorrhage ensues. For there is not, as in ordinary gangrene, more especially when of the chronic kind, the solidifying of arterial contents, with occlusion of the canal up to the nearest collateral branch (p. 236). Death of the part being rapid, the slough is peculiarly humid and soft. Circulation, though feeble, goes on till sphacelus is complete; and, besides, it is probable that the blood's power of coagula[illegible]en much impaired, as happens in other examples of poison[illegible]ystem.

This bleeding may be favorab[illegible]erly stated (p. 227), if only to such an extent as to affect the part; so[illegible]ving the inflammation, which precedes and leads to the local death. More frequently, it is profuse and prejudicial; increasing the prostration, and hastening the fatal issue. "The third and last stage was now fast approaching. The surface of the sore was constantly covered with a bloody oozing; and, on lifting up the edge of the flabby slough, the probe was tinged with dark-colored grumous blood, with which also its track became immediately filled. Repeated and copious venous bleedings now came on, which rapidly sank the patient; the sloughs, whether falling off spontaneously, or detached by art, were quickly succeeded by others, and discovered on their removal small thickly-studded specks of arterial blood. At length an artery sprung, which, in the attempt to secure it, most probably burst under the ligature; the tourniquet or other pressure was now applied, but in vain; for while it checked the bleeding, it accelerated the death of the limb, which became frightfully swelled and horribly fetid. Incessant retchings soon came on, and with coma, involuntary stools and hiccup, closed the scene."[2]

Or, instead of advancing to a fatal issue, recovery may take place. In this country, and at the present day, this is the general rule; death, and even much local destruction, forming the exception. Constitutional disorder gradually abates; pain diminishes; and the inflammation of gangrene is succeeded by that of arrest. Sloughs separate; and are neither renewed, nor supplanted by phagedena. Discharge becomes less copious, thin, and fetid; more purulent, and laudable. Granulation and repair are established. But such amendment is not to be reposed in implicitly. Anxious care is yet requisite; for relapse is by no means unfrequent.

Treatment.—As in hospital erysipelas, prevention is our chief object; and is to be obtained by similar means (p. 347). When the disease has occurred, the treatment is of that kind formerly recommended for sloughing phagedena in general (p. 227). Locally, escharotics,[3] efficiently applied, and repeated, if necessary, followed by poulticing or water-dressing, until sloughs separate, and healthy granulations appear. Constitutionally, gentle yet effectual unloading of the primæ viæ; calmatives; anodynes; if need be, stimuli. Bleeding, or other powerful antiphlogistic remedies, are never warantable; and mercury is to be avoided, as a poison. On arrest of the local disease, the constitutional disorder often voluntarily subsides. By the chlorides of lime or soda, fetor may be corrected.

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[1] Hennen's Military Surgery, p. 219. [2] Ibid. p. 220.

[3] Some use the potassa fusa both as an escharotic and as a lotion; first applying it in substance; next day using it in solution, ℈i to ℥i of water; every day diminishing the strength of the solution by four or five grains, to the fifth day, when the wound is simply dressed. Brit. and For. Med. Chir. Rev. Oct. 1850, p. 546.

See Pouteau, Œuvres Posthumes, tom. iii, 1783; Dussaussoy, sur la Gangrene des Hôpitaux, Geneve, 1787; Leslie, de Gangræna Contagiosa, Edin. 1805; Blackadder, on Phagedæna Gangrenosa, Edin. 1818; Brauer, Observationes de Gangræna Nosocomiali, &c., Lipsiae, 1820; Ollivier, du Gangrene ou Pourriture des Hôpitaux, Paris, 1822; Boggie, Trans. Med. Chir. Ed. vol. iii, 1828; Hennen's Military Surgery, Lond. 1829; Liston, Lancet, vol. i, p. 57, 1844; Ballingall, Outlines of Military Surgery, p. 163, Edin. 1844.

FURUNCULUS, OR BOIL.

This is a limited inflammation of a small portion of skin and areolar tissue; ending in death of the latter, and accompanied by laudable suppuration; always of the sthenic type. It is not a mere pimple. For that is but inflammation and suppuration of an obstructed sebaceous follicle. Nor is the term to be regarded as synonymous with carbuncle. For that is more extensive originally, liable to spread secondarily, and both generally and locally asthenic throughout; sometimes, nay frequently, bringing life into serious peril. Whereas, the boil is not only sthenic in itself, but rather indicative of a robust and plethoric system. At all events, the attendant constitutional disorder partakes, more or less, of the true inflammatory type; and requires to be treated accordingly.

The affection is most frequent in the young and middle aged; and in those who eat freely, and are liable to stomachic and hepatic derangements. The most common site is where the skin is thickest, and perhaps most removed from abstergence and ablution; on the back, shoulders, hips, back of the neck, and thighs.

Boils seldom occur singly, but are gregarious. The swelling is of a conical shape; its apex yellow; its base hard, red, and exquisitely painful. The pus is superficial; the slough is at the base. Sometimes the slough, or core, as it is commonly termed, consists only of areolar tissue; sometimes a portion of the true skin is implicated; not unfrequently an addition is given to its bulk, by commixture with fibrinous exudation. If left to itself, the boil bursts at the apex; and the matter escapes by a single aperture. Sometimes this is sufficient to permit a free passage to the slough, when loose; more frequently, it is insufficient for this purpose. On purulent discharge taking place, the pain, heat, and surrounding swelling usually abate. But subsidence is not complete, until slough, as well as matter, has been extruded; the former, so long as retained, acting the part of a foreign body, and maintaining inflammatory disorder.

The predisposing cause is derangement of the primæ viæ, and consequently of secretion in general. The exciting is some direct stimulus of the part; as by a prick, scratch, or evulsion of hair. Not unfrequently, no exciting cause exists; the predisposing, alone, is sufficient.

Treatment.—During the nascent condition of the inflammatory process, fomentation is used; with water-dressing, or poultice. On suppuration having occurred, an incision is made in the apex; sufficient to insure discharge, not only of the pus, but of the slough also. If an opening already exist, it is dilated; for the like purpose. The part is kept at rest; and, after ejection of the slough, the granulating wound is dressed in the ordinary way. Constitutional treatment—not the least important—consists of purgatives, followed by alteratives; to cleanse and rectify the primæ viæ. And somewhat of the antiphlogistic regimen should be enjoined through[illegible]le process of cure. To prevent relapse, experience speaks [illegible] two very opposite remedies; alkalies, and mineral acids; the [illegible]ssæ, and the dilute sulphuric acid; given in small doses, three t[illegible]y, and continued for a considerable period. In each case, the ordinary gastric indications will determine which class of remedies happens to be the more suitable.

In addition to the references under Inflammation, see Berlen, de Furunculo, Gott. 1797; Jourdan, Article Furoncle, Dict. de Scien. Med. vol. xvii; Dupuytren, Leçons Orales, vol. iv, p. 109; Dict. of Pract. Med. Article Furuncular Diseases. See also Biett, Cazenave, and other authors on cutaneous diseases.

ANTHRAX, OR CARBUNCLE.

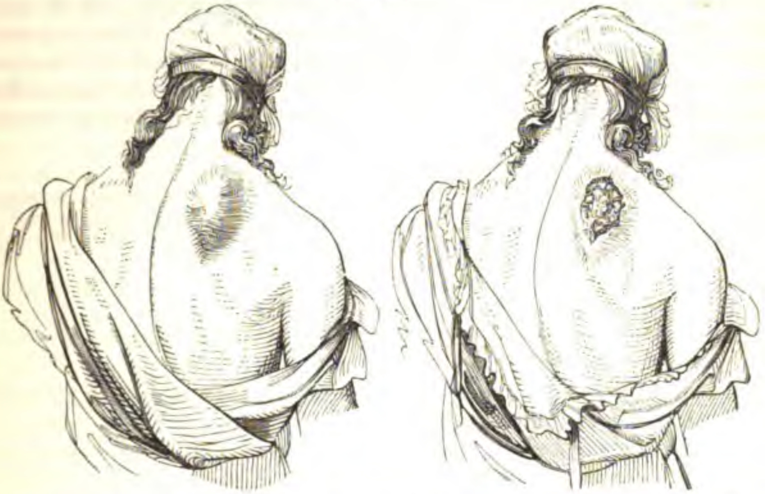
This is more extensive, and altogether more important, than the preceding. Inflammation, of an asthenic type, attacks the areolar tissue; and this sloughs, at an early period of the invasion. The superimposed skin is secondarily, and less involved; becoming gangrenous, only to a comparatively slight extent; and not continuously, but usually in small unconnected patches. Through the openings thus formed, a fetid, sanious pus oozes out; with portions of sloughed, and disintegrated areolar tissue. The general swelling is flat, dark, and spongy. A dull, burning pain is felt in the part; and, in the early stage, is much increased by pressure. The surrounding integument is livid, painful, and swollen. According to Dr. Prout, a saccharine state of the urine often coexists.

Carbuncle is usually found in the same situations as furunculus; but, unlike it, is generally solitary. It may vary in size, from that of a prune, to that of a soup plate. Progress is usually slow; and ordinarily limited to the surface. But, sometimes the deeper parts are also involved; so as to expose cavities, canals, and bones.

The constitutional symptoms are asthenic throughout; at first of a simply febrile and bilious character; then showing typhoid signs; and, as the hidden gangrene extends, tending rapidly towards prostration—more especially in the old—with hiccup, cadaverous countenance, feeble pulse, delirium, and coma.

The disease most commonly occurs in those of middle age, or further advanced in life; and especially in those who have indulged, freely and habitually, in the pleasures of the table. It is not contagious. The constitutional symptoms invariably precede. The local change begins with a hard, painful swelling, mainly subcutaneous; which rapidly enlarges, with dark discoloration, and burning pain. Vesicles form on the skin; and, on the cuticle giving way, the sloughy apertures of the integument are disclosed, as formerly described.

Fig. 110.



A common seat of carbuncle shown; in the one case occult; in the other open, exposing the infiltrated areolar tissue.

Treatment.—Free and early incision is to be made, usually of the crucial form, throughout the whole extent of the diseased mass. This evacuates the purulent formation; affords an exit for the sloughs, when loose; and limits infiltration. But this is not enough. Potassa fusa follows the bistoury; and is used freely. By it, the dying parts are at once converted into a dead eschar; healthy separation is accelerated; and injury of the system, from absorption of the deleterious products of humid putrescence, is almost at once arrested. And, further to insure fulfilment of the last indication, the slough, as it loosens, is to be carefully removed; by knife or scissors. The practice seems severe; but no other will prove, in all respects, successful. And the more advanced the case, the greater the necessity for its adoption. Less pain is occasioned than might be supposed; the greater part of the cauterized tissues being already in a gangrenous state. Poultice is applied till the slough is discharged; then water-dressing, early medicated to meet approaching debility.

Constitutional treatment is never thoroughly antiphlogistic. At the commencement, evacuants are necessary. For the stomach and bowels; an emetic, and purgation. For the liver; mercury, cautiously administered. Then, occasional alteratives; as, perhaps, the hydrargyrum c. cretâ. Tonics and stimuli are early required; bark, wine, ammonia, brandy, turpentine enemata; according to the features and exigencies of the case. So long as the power of swallowing remains, remedies are to be perseveringly administered; for, provided suitable local treatment have been practised, patients often rally completely, even though previously in extremis. Omit the use of the bistoury and potass—and all constitutional care, however skilful and unwearied, will not arrest the tendency to collapse, or avert a fatal issue.

These strong expressions, in favor of strong remedies, are of course applicable only to the more serious and urgent cases. There are many examples of the disease, in which the swelling is but small, and constitutional disorder proportionally slight. In these, simple incision suffices. In a day or two, the slough is discharged; and granulation advances favorably.

In addition to the references under Inflammation, see Frank de Carbunculo, Heidelb. 1682; [illegible], sur l'Anthrax, Paris, 1765; Larrey, Mem. de Chir. Militaires, vol. i, p. 104; Dupuytren, Leçons Orales, vol. iv, p. 109; Dict. of Pract. Med. Article on Furuncular Diseases.

DIFFUSE INFLAMMATION OF THE AREOLAR TISSUE.

This resembles the phlegmonous erysipelas; but the skin is not originally involved. In the subcutaneous areolar tissue, an asthenic and rapidly destructive inflammation occurs; causing profuse secretion of [illegible] pus: which is extensively and diffusely infiltrated, entailing [illegible] consequences on the texture so affected. The skin is [illegible], or covers a mass of slough soaked in purulent secretion, ere [illegible] has itself begun to inflame. Sooner, or later, however, it does [illegible] process; and this, occurring after loss of both mechanical [illegible] support, soon overcomes vitality. It sloughs to a greater or [illegible] and, on detachment of the dead portions, the gangrened [illegible] is disclosed. There is no limiting fibrinous exudation, of [illegible]; the surrounding tissues are all open and defenceless, [illegible] by continued infiltration, to an almost indefinite extent [illegible]

[illegible] affection is connected with the inoculation of a specific [illegible] has the doubly unfavorable effect of raising inflammation, [illegible] both system and part—but especially in the latter—[illegible]. The bites of reptiles, stings of insects, and [illegible] during dissection, are familiar examples of such ex-[illegible] matter may come from within; not the less [illegible]. For example, urine, infiltrated into the [illegible] light up an asthenic and rapidly destructive [illegible] speedy extension of the mischief, by diffuse [illegible] inflammatory product; and the skin [illegible] extensively.

[illegible] areolar infiltration, however caused, are [illegible] never, even at the first, is there inflammatory [illegible] erysipelas—the disease which it most closely [illegible] tenderness, a puffy diffused swelling, heat, [illegible]; but with no appr[illegible]imary affection of the skin; which retains its normal hue, and may seem even paler than the surrounding parts. Very soon the swelling, increasing fast, causes tension of the integument; and speedily thereafter the skin reddens, inflames, and stands much in danger of perishing; by sloughing, ulceration, or both. When the surface has given way, discharge is profuse, thin, offensive, often bloody, and mingled more or less with the disintegrated areolar tissue.

Constitutional symptoms immediately follow the first accession of the local; and rapidly increase in severity. They are those of constitutional irritation; and tend strongly to the typhoid character (p. 127).

Treatment.—The nature of the inflammation is such as to afford no hope of its arrest, before the suppurative crisis has been attained. Leeches and punctures are of no avail; there is no time suitable for their employment; the morbid change almost at once reaches suppuration; and herein again, therefore, the affection differs both from erysipelas, and from the ordinary inflammatory process. A certain amount of areolar tissue must be broken up and perish; treatment can only mitigate the mischief already done, and prevent its further extension. Incision is to be freely made; throughout the whole extent of the infiltrated part. Or, if the infiltration be so situated as to render such extensive cutting unsafe and inexpedient, at least let the wound be free, early, and dependent. The infiltrating fluid escapes, tension is relieved, and a sufficient drain is left for the continued secretion, with space and freedom enough for discharge of the parts already destroyed. The subsequent local management, and the constitutional treatment throughout, are to be conducted on precisely the same principles as in the advanced cases of phlegmonous erysipelas; in which similar injury has accrued to both part and system (p. 344).

For the Literature, see Inflammation and Erysipelas; especially Travers on Constitutional Irritation, Part I.

ENTOZOA WHICH AFFECT THE INTEGUMENT.

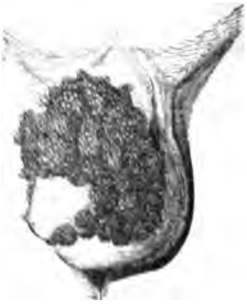
In the West Indies, a small insect, the *Chigoe* (*Pulex penetrans*), lodges in the areolar tissue of the foot, and breeds there, causing great itching of the part; and forming a small cyst, which enlarges into a subcutaneous swelling about the size of a pea. Treatment consists in extraction of the cyst, entire; otherwise, serious inflammation is apt to ensue. To insure thorough extirpation, the use of an escharotic may sometimes be expedient.

In China, India, Africa, and other hot climates, the *Guinea worm* (*Dracunculus*, or *Filaria medinensis*) troubles mankind; lodging, like the other, in the subcutaneous areolar tissue; having probably penetrated the skin when small. As it grows, a painful and itchy swelling forms; sometimes corded; sometimes like a varicose vein; sometimes more diffuse, like an abscess. Ultimately, suppuration, takes place, the skin gives way, the animal is partly exposed, and a painful festering sore remains. While the animal is merely enlarging in bulk the disturbance it occasions may be but slight; but when the period of reproduction arrives, it seeks to perforate the skin, and causes furunculous excitement. If injured then, a milky fluid is found to exude from it, which under the microscope, shows myriads of young worms.[1] So long as the worm retains its lodging, inflammation continues; and may become serious by intensity and diffusion. To prevent this, and obtain healing, it is necessary to extract the animal; not at once, but gradually. A portion, having been exposed, is attached to a small roll of plaster, or other suitable substance; and by gradually winding it on this roller, day by day, the creature is removed entire. An attempt at immediate extrusion is sure to fail; the worm breaking short, growing again, and reproducing the inflammatory evils.

TUMORS OF THE INTEGUMENT.

Warts are of two great classes; Simple and Malignant. The simple are considered to be prolongations of the papillæ, changed somewhat in structure as well as hypertrophied; sometimes flat and diffused; sometimes prominent, and cylindrical in form. When situate on the outer part of the body, the investing cuticle is thick, rough, and dry. On the inner part of the body, and more especially when opposing surfaces are affected, as in the thighs and nates, the cuticle is thin and delicate; and a serous discharge is exhaled.

Fig. 111.



Warts on the penis.

These formations may again be divided into Common and Specific. The former of spontaneous origin, unconnected with any apparent cause; usually dry and non-contagious. The latter dependent on venereal or other poison; humid; and contagious. Sometimes these latter attain an enormous size.

The vitality of such structures is weak; and occasional touching with a minor caustic—such as nitrate of silver, aromatic vinegar, a solution of corrosive sublimate, powder of savine, &c.—suffices for their destruction. If the form of the wart be suitable, a more summary process of removal may be accomplished, by knife, scissors, or ligature. The large venereal warts bleed copiously when excised.

Warty formations are frequently of a malignant kind, in the aged; and are most commonly situated on the face. The wart is of an angry and irritable character; and soon degenerates into cancerous ulceration, surrounded by more or less carcinomatous deposit. The remedy is free removal by excision; if possible, before open degeneracy has been fully established. All warts of the face, indeed, should be removed; at whatever age, and however simple their nature may seem to be; all being most prone, if not certain, to degenerate in advancing years.

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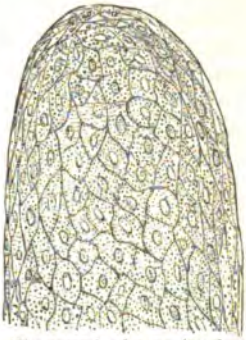
[1] Maisonneuve. Lancet, No. 1119, p. 153.

The skin is liable to simple *Hypertrophy;* extending over a considerable surface. The texture becomes rough and open; the rugæ and markings are large and broad; and the sebaceous follicles are unusually distinct. Pressure, and the use of iodine, suffice at least to arrest increase of growth; and considerable diminution may even be effected. Should the bulk be great, and prove troublesome, the changed texture may be removed by incision; either wholly or in part. Being a simple hypertrophy, and not a true tumor, partial removal does not entail reproduction.

Hypertrophy of the skin, however, is more frequently associated with a similar condition of the subcutaneous adipose and areolar tissues; constituting a species of *Lipoma*. To this, the integument of the face, especially of the nose and cheeks, is subject. At the same time, there is much discoloration of the skin by constant passive congestion. The cure is, removal by careful dissection; the general health being at the same time attended to. Usually, there is a great necessity for alteratives, and regulation of diet.

Fig. 112.



The summit of a papilla from an epidermic growth, the result of a burn. Each papilla consisted externally of numerous epidermic scales distinctly nucleated, compressed together. Internally it was composed of fibrous vascular tissue.—BENNETT.

The nævus and erectile tumor, carcinoma and cancer, are often met with in the integument; amenable to the ordinary rules of treatment. And the encysted tumors, as we have already seen, are usually situated on the surface.

See the Literature of Tumors.

CHAPTER XI.

AFFECTIONS OF THE SEROUS AND MUCOUS MEMBRANES.

THESE belong rather to the department of the physician, than to that of the surgeon; still it is necessary to notice them shortly here, surgery being not unacquainted with both their immediate and remote consequences.

The Inflammatory Process affecting Serous Membrane.

Serous membranes are especially liable to assume the inflammatory process; with or without a direct exciting cause. The process varies, according to circumstances, in its kind and degree; and, as it varies, so do the results. Under all circumstances, it is apt to spread widely and rapidly, by continuity; and in all acute cases the constitutional symptoms are severe. Usually, also, much local pain attends.

At first, the natural secretion may be diminished or arrested; afterwards it becomes more profuse, containing fibrin, and also a greater proportion of albumen than is usual (p. 117). The balance between deposit and absorption may, in the outset, scarcely be overborne; but very soon accumulation is begun, and advances; constituting dropsy. Such accumulating fluid departs more and more from the healthy standard; ultimately becoming puriform, and often containing more or less of true purulent admixture. But the membrane itself undergoes important change; at first injected and spongy, afterwards enlarged and roughened; and often coated, more or less thickly, with plastic exudation which becomes organized, and variously modified in structure, as formerly mentioned (pp. 119 and 122). In chronic disease, of a mild type, simple thickening and opacity of the membrane take place, accompanied with more or less effusion; as is frequently observed in the arachnoid.

By the serous accumulation, dropsy is produced; and injurious consequences may ensue, on account of the mere bulk of the effusion; independently of other circumstances attendant on the morbid process. By the plastic exudation, opposing surfaces may be united and incorporated; sometimes producing harm, as when the heart adheres to its pericardium, or the lung to the pleura costalis; sometimes, however, productive of much benefit, as when the bowels so cohere on their serous surfaces as to prevent purulent irruption, or fecal extravasation, into the general peritoneal cavity. It is seldom that acute dropsical accumulation occurs, without plastic change in the membrane; it is not uncommon, however, for agglutination of opposite serous surfaces to take place, even extensively, with but little accumulation of serum.

While the serous tissue is especially liable to produce abnormal deposit of both serum and plasma, and while also the formation of pus is not uncommon in connection with altered membrane and dropsical accumulation, the higher results of inflammation—ulceration and gangrene—are fortunately rare. The latter is seldom observed unless when extending on a large scale, and in an acute form, from other parts; against the former, serous membranes are especially endowed, like all fibrous tissues—as formerly stated (pp. 130 and 183).

The connection of diseases of the serous membranes with surgical practice is very apparent, in relation to wounds and other injuries of the head, chest, and abdomen, and in the management of hydrothorax, empyema, and ascites. The treatment of acute disease is conducted on ordinary antiphlogistic principles.

The Inflammatory Process affecting Mucous Membrane.

The mucous is liable to inflammatory change, perhaps still more frequently than the serous membrane. The results are more various.

Simply inflaming, the membrane is congested and swollen; at first dry, afterwards pouring out an increased and vitiated secretion. The submucous areolar tissue is occupied by serous or fibrinous deposit; and, in the more severe cases, extravasations of blood are sometimes found. The surface of the membrane is altered, becoming rough and spongy; the papillæ are enlarged and prominent; and the follicles are swollen, with diminished orifices. Sometimes the general swelling, by submucous effusion, is very great; and may be productive of the most serious consequences, as in œdema glottidis (p. 103). The increased secretion soon changes from the simply mucous character; becoming opaque and glutinous, afterwards puriform, and ultimately purulent. In acute and severe cases, such discharge is often of a greenish color, and may be mixed with blood; as in gonorrhœa. Sometimes the discharge contains much blood, or may even seem entirely sanguineous; as in acute cystitis; where, however, there is often ulceration. Intense exacerbation of the affection may temporarily arrest all discharge (p. 108).

A spreading inflammatory process, of an erysipelatous character, is not unfrequent; arising, apparently, from the same predisposing and exciting causes as erysipelas; and, in fact, often associated with that disease. It, too, is liable to be attended with great swelling; and may extend over a large amount of membrane.

While serous structures often produce false membrane, this result is comparatively rare in the mucous surfaces. And yet, in certain parts, it is not uncommon; as in the air-passages, especially the larynx and trachea. From the bladder, too, false membrane, even of large extent, has been thrown off; and from the lining of the intestines, similar productions are by no means unfrequent. Such exudation, however, differs greatly from true plasma; inasmuch as it is separated from the mem-
y viscid mucous secretion, and is seldom vascularized, or incorpo-
h the original tissue. It is sometimes patchy and thin,

originating apparently from the follicles, as in Diphtherite; sometimes thick and tubular, as in croup, and tubular bronchitis. The serious consequences of such formation, in any part of the air-passages, can be readily understood.

Suppuration, it has been already stated, is a common result of mucous inflammation, while the membrane is yet entire; as in gonorrhœa. But frequently the membrane does give way. Pustules form; often in the follicles; as similar formations occur in the analogous texture of the skin. The pustule breaks, and ulceration follows, with purulent discharge; the raw surface consisting of many isolated points, or of one continuous breach made by pustular coalition. Such changes are most frequently observed in the intestines, and in the mouth and fauces; in the latter situation they are termed Aphthæ. Ulceration, however, is not always of pustular origin. It may originate from intense inflammation, as in other textures; spreading both in depth and surface; often accompanied with great constitutional disturbance, as in dysentery; and even when healed, producing serious consequences, by contraction or other alteration of the affected part—as in the bowel or urethra, and in the gullet or windpipe. Or changes may take place exterior to the part, requiring subsequent surgical operation; as in the case of fistula in ano, induced by ulcer of the rectum. Or the result may be immediately fatal; as in perforating ulcer of the stomach or intestine. In some cases, however, comparative proneness to ulceration, when contrasted with the serous membrane, is no disadvantage; as in the evacuation of abscess which has been balked in the natural effort of reaching the integumental surface (p. 183). In the intestine, and also in the windpipe, ulceration is often the result of tubercular deposit.

Intense asthenic inflammation may terminate in gangrene of the membrane; as in the worst form of Cynanche, and in some cases of Dysentery. This result, however, though more common than in serous membrane, is still, in reference to other tissues, comparatively rare.

The chronic inflammatory process, affecting the mucous and submucous tissues, often produces serious alterations of structure. The papillæ and follicles undergo enlargement and permanent change; the membrane is thickened; and by such thickening, but mainly by submucous deposit, contraction of the canal occurs. Or ulceration may take place, slowly advancing; by perforation, endangering life; or, by contraction in healing, compromising the functions of the canal.

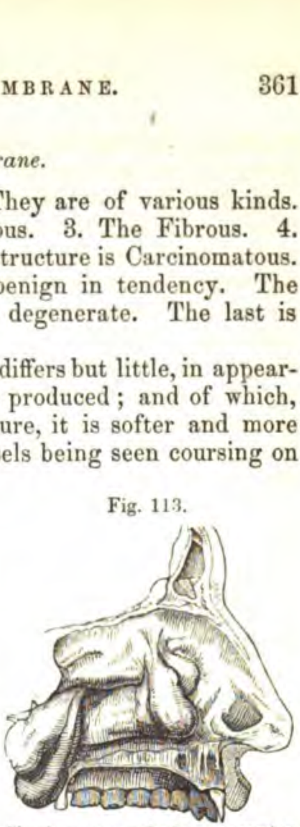
The treatment of inflammatory affections of mucous membrane is conducted according to general antiphlogistic principles. In the simpler forms, in accessible parts, great benefit is derived from light use of the nitrate of silver, as in similar affections of the skin (p. 157). Fibrinous results may urgently demand surgical interference; and so may the œdematous; as in the windpipe. Ulceration, too, as already stated, may lead to operation; and contraction by mucous change and submucous deposit is the subject of daily manipulation, in the case of stricture of the urethra. Such matters, however, will be more suitably discussed hereafter.

Tumors of Mucous Membrane.

To these the term *Polypus* is applied. They are of various kinds. 1. The Simple Mucous. 2. The Cysto-mucous. 3. The Fibrous. 4. The Medullary. Sometimes, but rarely, the structure is Carcinomatous. The first two are simple in structure, and benign in tendency. The third is of doubtful character, and prone to degenerate. The last is most malignant.

1. *The Simple, Benign, Mucous Polypus* differs but little, in appearance, from the original texture in which it is produced; and of which, indeed, it is but an hypertrophy. In structure, it is softer and more pulpy; less vascular, only a few sluggish vessels being seen coursing on its exterior; of paler hue, and of much less sensibliity. The mass is pyriform, attached by a narrow peduncle. They seldom occur singly, but in clusters; the majority, however, being for a time held in the background, by one or two large tumors, which fully occupy the space in which they grow. The attachment does not extend to a greater depth than that of the mucous membrane. They are most frequently found in the nasal passages; in the uterus they are common; more rarely they are connected with other parts of the genito-urinary system; and the respiratory and alimentary canals are not altogether exempt.

Fig. 113.



Simple mucous polypi, seen growing in the nasal passages.

Treatment is by evulsion. The tumor is laid firm hold of by forceps, at its narrow neck, as close as possible to the point of attachment; and, by a twisting movement, combined with that of gentle pulling, the attachment is torn away, and the part removed. There is no reproduction; but there may be an appearance of it. For some of the small polypi—formerly compressed, and squeezed close to the roots of the larger—now expand and grow apace. The disease is reproduced, doubtless, though not by return of the original tumor; and of this circumstance it is necessary to apprise the patient to prevent disappointment. The hemorrhage that follows is slight; and is easily restrained by pressure. No violence is necessary, in the evulsive effort. It is besides inexpedient; tending to tear away an unnecessary extent of membrane, perhaps with a portion of subjacent bone, and also to augment the hemorrhage. If the polypus be large, and situated unfavorably for the use of forceps, its neck may be included in ligature; so as to cause sphacelation of the mass.

2. *The Cysto-mucous Polypus* may be original; or the preceding form, by long endurance, may change into this. The structure is not homogeneous; but contains cavities, filled with clear, glairy fluid. The color is paler; at the fundus, often of a whitish hue, like an oyster. The texture is more dense; especially at the parietes of the cysts, which are sometimes almost cartilaginous. The form, attachment, tendency, and

treatment, are the same as in the benign form. This variety seldom occurs but in the nostrils.

3. *The Fibrous Polypus.*—This is of the same structure as the fibrous tumor (p. 271); invested by mucous membrane; of a cylindrical shape; and attached by a broad base—a little less extensive than the apex of the tumor—not only to the mucous membrane and subjacent tissue, but, in the case of the nostrils, also to the periosteum; indeed, it may be said to be connected with the bone itself. Like the preceding varieties, it is the seat of little or no pain, and proves inconvenient chiefly by its bulk and position. But, while the others seldom if ever degenerate into the medullary or other malignant formation, this is prone to do so. Early removal is therefore expedient. If the neck be unusually narrow. the shape being more pyriform than is its wont, deligation may be employed. But, in the majority of cases, excision is demanded; it being most expedient that no remnant of the morbid structure should be left, lest reproduction ensue. And in order to effect this thorough removal, preliminary incisions, perhaps severe, are requisite in certain situations; as will afterwards be shown. The fibrous polypus most frequently occurs in the nostrils, and in the uterus; sometimes in the pharynx, rectum, and vagina.

4. *The Medullary Polypus* may be a degeneration of the fibrous; or of original formation. Most frequently it is the latter. Occasionally, it is associated with carcinoma. It follows the usual course; and, when original, no hope of cure need be entertained. Its most frequent sites are the nares, antrum, pharynx, and œsophagus. In some few cases, when the formation is yet recent and apparently limited, and when it has been of secondary origin, free removal of all suspected as well as of all implicated parts may be warrantable. But, in the great majority of cases, palliation only is within our reach; and we should attempt no more.

Similar observations apply to the nature, progress, and treatment of the carcinomatous growth; which is more rare in connection with mucous membrane.

See Gendrin, Histoire Anatomique des Inflammations, vol. ii, Paris, 1826; Bretonneau, de la diphtherite, &c., Paris, 1826; and Bayle, Dict. des Sciences Médicales, Article Œdeme de la Glotte. See also the general references under Inflammation and Tumors.

CHAPTER XII.

AFFECTIONS OF THE PERIOSTEUM AND BONE.

To the inflammatory process occurring in the investing membrane of bone, the term *Periostitis* is applied; in the substance of the bone itself, that of *Ostitis*. But be it understood that these terms are not synonymous with true inflammation of the tissues affected, but include the whole range of the inflammatory process, from its first and slightest commencement, up to its highest and most destructive result.

According to the issue, various names are applied: Plastic matter may be exuded, causing *Node* or *Hypertrophy* of bone; absorption may occur, causing either general *Atrophy*, or local loss of substance; suppuration, *Abscess* of bone; ulceration, *Ulcer;* ulceration of an intractable and peculiar kind, *Caries;* death of bone, *Necrosis.*

Periostitis.

This may be the result of direct external injury, as by a wound or blow; and then its character is usually acute. Or it may originate from internal causes; and from none more frequently, than from a vitiated state of system induced by venereal taint, or by imprudent and unnecessary mercurialism. Then its progress is usually more chronic. Or internal causes may be combined with external; the former predisposing while the latter excites. Mercurialism may coexist, for example, with exposure to untoward atmospheric influence; and, in such circumstances, the disease may partake of both the chronic and the acute characters. The periostitic patient is generally at, or above, the middle period of life.

Sometimes the affection is of secondary invasion; extending from the bone, even in its interior; or a prolongation of the process spreading deeply in the soft parts.

Fibrous tissue, such as periosteum, is not particularly prone to assumption of the inflammatory process; nor, when assumed, does that process tend to rapid and deleterious advance, provided it be limited to that tissue. How rarely, for example, does suppuration occur in purely rheumatic affections, however acute; and we have repeatedly seen how comparatively difficult it is for ulceration to seize on any fibrous investment. But the process, if at all acute or considerable, is seldom limited to the tissue originally affected; both the subjacent and the superimposed tissues become involved; the ordinary inflammatory results proceed both above and beneath; and on these, in the latter situation, the unyielding nature of the fibrous tissue reacts most unfavorably, causing much aggravation.

Periostitis, whether chronic or acute, is from the first usually attended with great pain; on account of the unyielding nature of the tissue affected. And when, in the acute form, the affection has reached the subjacent bone—as very early happens—then pain becomes excruciating. For the inflammatory process is more active in the textures secondarily involved; tendency to exudation is much increased; and this, being confined on either aspect by periosteum and bone, sadly aggravates pain, at the same time hurrying on the higher and more destructive results of inflammation. A[illegible]g with pain, there is great intolerance of pressure; the lightest touch adding much to the suffering. Swelling is not great; but from the first tense, and very perceptible to both sight and touch, especially to the latter. At first the skin is pale, lax, and uninvolved in the painful swelling beneath; sooner or later, however, swelling becomes more diffuse and general, and the integument grows tense, red, and tender. All the symptoms, but more especially the pain, undergo nocturnal exacerbation—as happens in most affections of the hard textures; and the aggravation is not least distinct in those cases which are most chronic in their nature. Day is the period of waste; night, that of repair. The inflammatory process, in its lower grades especially, may be considered as analogous to the latter function—nutrition in an exalted and perverted form; its nocturnal exacerbation, therefore, may be regarded as but obedience to a general law. It is probable that the inflammatory process, wherever situated, undergoes this nocturnal change; but the occurrence is naturally most marked in affections of unyielding textures, where decided increase of turgescence and exudation must be accompanied by corresponding aggravation of pain.

Periostitis is invariably accompanied by important constitutional symptoms. If the affection be acute, there is much inflammatory fever. If slow and chronic, there is palpable derangement of health, of a corresponding type. The patient grows pale, weak, and thin; loses his strength, spirits, and appetite; sleep is broken, or altogether dispelled, by the nocturnal exacerbations; constitutional irritation is plainly developed; it assumes the hectic type, and may advance to most formidable severity.

The membrane is found changed; thickened, and increased in vascularity; softened in the acute form, dense in the chronic; in the acute loosened from its connection with the bone, in the chronic adhering to it with unnatural firmness. Exudation takes place on both its aspects: diffuse exteriorly, limited towards the bone. In the latter situation, if the process proceeded no higher than active congestion, the fibrinous deposit, being more or less plastic, may become organized. A distinct, firm, tender swelling results; termed *Node*. This consists of thickened periosteum, having in and beneath it plastic fibrin, which is undergoing organization; exuded partly from the periosteum, partly from the corresponding surface of bone secondarily involved. And, unless either absorption return in great activity, so as to remove all excessive deposit, or true inflammation supervene to undo organization, that latter process not only advances to completion, but the fibrin makes transition to bone; the swelling then becoming less painful, more defined, hard, and unyielding. According to Mr. Goodsir, the periosteum, when raised by exudation beneath, "drags out or extends the processes which stretch from its internal surface into the superficial Haversian canals; and as the texture which occupies the canals is the formative organ of bone, these retracted processes are the centres from which new deposits of bone proceed."[1] In the simply fibrinous state, the swelling is termed a recent or *Inflammatory node;* when ossified, *Chronic* or *Confirmed.*

When the node is connected with venereal taint of the system, it is termed *Syphilitic;* when the result of mercury, *Mercurial.* Often there is a combination of the two, *Mercurio-Syphilitic.* These forms, especially the first, are usually more circumscribed and abrupt, and of a rounder form, than those nodes which are not connected with such predisposing cause.

On the cranium, ordinary nodes do not form. And when under the influence of syphilis, patches of the pericranium become affected by inflammatory disease, the result is either mere thickening of the membrane; or unhealthy suppuration beneath it, with subsequent involvement of the bone in ulcer, caries, or exfoliation. To such cases the term *Soft* node is sometimes applied.

When the process is acute and has extended from periosteum to bone, with exudation between, inflammation and suppuration are always likely to occur; the liquor sanguinis is no longer plastic, but degenerates into purulent formation. And such formation, happening between two most unyielding textures, induces aggravation of all the symptoms. The natural progress of the acute abscess outwards is arrested by the non-ulcerating fibrous investment; the areolar connections between the periosteum and bone are broken up; and the abscess extends laterally, notwithstanding the limiting fibrinous deposit—the bone becoming more and more stripped of its membrane. The inflaming bone, from the pressure of accumulating pus, becomes disintegrated by ulceration, at the point or points most compressed; or, being at once inflamed and deprived of its nutritive membrane, it is not unlikely to perish under the complication of evils, and become necrosed.

In acute periostitis, such destructive results may follow in the course of a few days; the system at first oppressed by grave inflammatory fever, subsequently exhausted by hectic. In the chronic form, weeks and months elapse, with but little change in the symptoms or apparent alteration in the structural results; but with a frame gradually yet plainly yielding before the continued irritation. In the latter class of cases, the membrane is found much thickened, dense, and increased in vascularity; the bone corresponding is usually adherent, opened out in texture, and roughened by nodules of osseous deposit.

In scrofulous patients, chronic periostitis is common in the extremities; often involving the whole girth of the limb, for some extent; and pro- g such firm hard swelling as may be mistaken for solid enlargement itself. In children, the phalanges of the fingers are specially liable to this affection. Wherever situated, it is seldom accompanied by urgent symptoms; and it is amenable to constitutional treatment suitable for opposing the predisposing cause; cod-liver oil proving particularly valuable.

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[1] Monthly Journal, Feb. 1850, p. 103.

In the neighborhood of a joint, periostitis is apt to extend to the synovial membrane; from the tibia to the knee, for example; a serious complication.

Near the hip-joint, on the posterior part of the pelvis, Mr. Stanley has observed periostitis to be peculiarly severe; when occurring as a secondary affection after parturition. In its symptoms, it simulates morbus coxarius; and is apt to be mistaken for it. Unless actively and early treated, suppurative involvement of the bone may hardly be avoided.

Periostitis over the trochanter major also simulates hip-joint disease. And in this case, too, the bone is liable to suffer secondarily; inflammation in it ending in troublesome suppuration and necrosis.[1]

Examples are not wanting of the whole skeleton having been involved in periostitis. Such cases, whether chronic or acute, are obviously of a most formidable character, and can hardly be expected to have other than a fatal termination. But, usually, the disease is limited to one chain of bones, to one bone, or to a portion of one bone. The parts of the skeleton most liable to be affected are those most exposed to external injury, whether by mechanical violence or atmospheric exposure; the shin of the tibia, the ulna, the clavicle, the sternum, and the bones of the cranium, especially the frontal. In all aggravated cases, either mercury or syphilis is usually much to blame; and the worst cases are those which occur in scrofulous patients, who have suffered from both the venereal disease and its supposed specific. The triumvirate of mercury, syphilis, and scrofula, is sadly inimical to health; many and serious diseases are liable to be induced; and of these, aggravated periostitis is one.

Treatment.—It is customary to state that function, healthy and morbid, proceeds with comparative slowness in bone and its investing membrane; but such is dangerous doctrine, and may lead to inert and injurious practice. It is surely no tardiness of progress which in a few days, from simple inflammation of the periosteum, brings abscess, ulcer, and necrosis—one, or other, or all. In truth, no disease calls more loudly for active and energetic treatment than acute periostitis; for by such treatment alone can disaster be avoided. At the very outset, leeches are to be applied in large numbers; counted rather by tens than units; and in the robust, young, and previously healthy, general bleeding may also be practised. Our object is to make a full and decided impression on both part and system; so as to avert the disease while there is yet time to save structure. The part is kept raised, relaxed, and rigidly at rest; and hot fomentations are diligently applied. Other antiphlogistics are not forgotten; starvation, antimony, purgatives. And disease having been thus subdued, its results usually disappear; gradually yet satisfactorily. If not, discussion is to be expedited by counter-irritation, and the internal administration of the iodide of potassium; making sure, however, that acuteness is subdued, before such remedies are adopted.

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[1] Stanley on Diseases of Bone, p. 349.

Sometimes the inflammatory process seems to be partially arrested, yet does not decline; a tense and painful swelling remains unabated, and on the contrary tending still to increase. It is plain that relief of tension would be a most important indication in such circumstances. For a similar state of matters, unconnected with bone, we would freely practise incision; tension would be at once relieved, and disease would speedily decline; the wound would suppurate, and its margins perhaps slough, but granulation and closure would speedily follow. Here, however, similar procedure would be rash and untoward. Tension would doubtless be relieved; but, with suppuration, which is inevitable, would certainly come either ulceration or death of the bone; the very results which we seek to avoid. Direct incision, therefore, is plainly unwarrantable. But, by inserting a fine bistoury, or tenotomy needle, at a little distance from the tense part; passing it over, cautiously, beneath the integument; then turning and pressing its edge, so as to divide the tense membrane wholly to the desired extent; cautiously withdrawing the instrument, so as to make a valvular, oblique, and subintegumental wound; and finally closing the single integumental puncture immediately, with isinglass plaster, or collodion—in fact by completing the wound so as effectually to prevent introduction of atmospheric influence, and thereby obviating the chief risk of suppuration—we may obtain diffusion of the swelling, relieve tension, and so facilitate both resolution of the process and discussion of its results. This manœuvre, however, requires skill and caution in its performance; and even with these it is not wholly devoid of risk. It is therefore not to be indiscriminately employed, but should be reserved for those cases which otherwise prove obstinate, and in which aggravation and suppuration seem imminent.

When matter has formed, acutely, beneath the periosteum, direct incision cannot be too early had recourse to. The part is to be treated as in ordinary acute abscess. By no other procedure can the mischief threatened to the bone be either limited or averted. Abscess having already formed, subintegumental wound is unnecessary; further, it is inexpedient, as insufficiently evacuating the pus. If the wound be early, simple ulceration only will have taken place; on evacuation of the abscess, ulceration quickly subsides, its cause having been removed; reparative effort then commences, and advances harmoniously with granulation; and hard and soft parts cicatrize together. If incision be delayed, the ulcer not only deepens and extends, but is apt to degenerate, and prove slow to heal; or necrosis may occur to a greater or less extent.

But it is plain that this practice, so obviously beneficial in the case of acute abscess, is never to be employed, unless when the indications of such a state of matters are most distinct and satisfactory. Only when the tactus eruditus, and other signs of suppuration, convince us that pus is really in some quantity accumulating between the periosteum and bone, is direct incision at all advisable.

A most formidable example of acute inflammation involving both periosteum and bone, probably originating in the former, not unfrequently occurs in young persons, after injury of the extremities. A kick or blow has been sustained on the shin, for instance. Intense pain follows, accompanied with rapid swelling, over the whole tibia; there is great intolerance of firm pressure, the skin is white and normal, the subcutaneous areolar tissue is œdematous; constitutional disturbance is inflammatory and intense. Blood, oil, serum, unhealthy pus, are fast accumulating beneath the periosteum; the tibia is stripping rapidly; and the neighboring joints may become suppuratively involved. General necrosis is inevitable. Nothing but free and timeous incision can limit disaster. Nothing can prevent it. And the probability is, that early amputation will be required to save life.

In chronic periostitis, we begin with leeching; but in a gentler way than in the acute form; not so much with the view of arresting or resolving disease thereby, as in order to pave the way for its more appropriate remedy—counter-irritation. A few leeches suffice; followed by fomentation; accompanied by rest, a [illegible] posture, and a careful diet. Blisters then follow in success[illegible] perhaps varied occasionally with liniment of croton oil; and accompanied by the internal administration of the iodide of potassium, in full doses. By this medicine, rest, and counter-irritation, the greater number of cases will be satisfactorily subdued. Sometimes on account of peculiar obstinacy, more potent counter-irritation may be expedient; the hot iron may be applied cautiously over the part. Should the iodide of potassium interfere much with the stomach, or seem to have lost its effect by habitual use, it may be either combined with or temporarily superseded by sarsaparilla.

Cod-liver oil, as already stated, is an excellent remedy in chronic affections suspected to be of scrofulous connection. In syphilitic and mercurial cases, the iodide of potassium has a wondrously remedial power; in large and sustained doses. Not unfrequently its action may be truly termed specific.

Occasionally pain continues severe, more especially at night, notwithstanding perseverance in such treatment; and in these circumstances it becomes advisable to give mercury, even although the case be one in which previous mercurialism is held to be the cause of the very evil now contended with. By many the bichloride is considered the preferable form in such cases; given cautiously, in doses of a twelfth or sixteenth of a grain, thrice daily; either simply in solution, or in pill with sarsaparilla and guaiac; its use to be discontinued, so soon as the symptoms have satisfactorily given way. The iodide of mercury, too, is suitable. But, as a general rule, mercury in any form is never to be given in periostitis, especially so as to produce a constitutional effect, unless other and safer means have proved unavailing. That mineral, we well know, is as likely to cause as to cure.

Neuralgia of the Periosteum.

This membrane is sometimes the seat of neuralgic affection. It may follow amputation; it sometimes results from a comparatively trifling injury. The part affected is usually of no great extent. The skin is free from redness and swelling, but very sensitive; there may be no apparent change of structure, in either periosteum or bone; but in the former texture severe pain is felt, varying and intermittent—in short, presenting all the usual neuralgic characters. Rest, endermic application of the nitrate of silver, and the internal administration of iron, bark, or some other of the many remedies held available in neuralgia, constitute the treatment. This failing, benefit may perhaps be obtained from the lodgment of a seton over the affected part.

Malignant Disease of the Periosteum.

Mr. Stanley believes that he has observed malignant fungus springing from the periosteum of the shin, which had been long and repeatedly the seat of inflammatory affection. The fungus was, in some instances, soft and flocculent on the surface, with a firm, grayish, gelatinous base; while in others it consisted of firm gelatinous substance throughout. Usually it was very sensitive; and, when injured, bled freely.

Malignant disease of this character, and in this situation, is certainly not uncommon; but there is room to doubt its invariable origin in the periosteum. In not a few examples, this tissue may be but secondarily involved.

However originating, the disease follows the ordinary course of malignancy, and the only remedy is by early amputation; ere yet the lymphatic system has shown itself involved.

Hypertrophy of Bone.

Bone is liable to simple enlargement, by excess of growth; slow, painless, and independent of the inflammatory process. Long bones are thus increased in thickness; and may be elongated also; producing both deformity and lameness, and simulating other affections—as disease of the hip-joint, and curvature of the spine. When the affection occurs in short bones, more serious results may follow. The superior maxilla, for example, may enlarge so as to obliterate the antrum and the nasal passages; also encroaching on the orbit, and displacing the eye. And, in such circumstances, extirpation of the hypertrophied bone, either in whole or in part, has been seriously contemplated.

After partial removal, return of the growth need not be dreaded; and therefore in most cases where surgical interference is deemed expedient, total extirpation of the offending part will not be necessary. This is common to all hypertrophies. In simple enlargement of the tonsils, for example, it is not necessary to dig out the whole gland, but merely to slice away the protruding part.

Atrophy of Bone.

Interstitial absorption may affect the whole of a bone, in conjunction with deficient nutrition; and the result is wasting or atrophy. Often it may be termed an indirect and remote consequence of inflammation. In what is ordinarily termed "white swelling" of the knee-joint, for example, wasting of the bones of the limb, more especially of the femur, is almost an invariable concomitant of the confinement to a sedentary or recumbent posture. Sometimes, in such cases, the wasted bones become so soft as to be readily cut with a knife. This state of matters is to be obviated by attention to the general health; but, chiefly, by cure of the articular disease, and consequent resumption of the wonted function of the limb. "Atrophied bone is, in some instances, simply diminished in size; in others its walls are thinned, and its cells widened; and, occasionally, the cancellous texture wholly disappears, and the bone after maceration presents the characters of the bone of a bird, with its simple tube and thin walls" (p. 258).[1]

Atrophy, like hypertrophy, may affect both the thickness and length of the bone; and serious results ensue. In the lower limb, for example, lameness will be great. A flat bone atrophied ceases to be an equally efficient protector of important parts beneath, as before; and fracture is rendered possible from even slight force.

In the way of treatment but lit [illegible] r power. In some cases, as already stated—when the cause [illegible] e inaction of the part—resumption of function may not only arrest the untoward change, but do something for its cure. If a scrofulous or rickety state of system exist, benefit will follow appropriate constitutional treatment.

Neuralgia of Bone.

Like the periosteum, bone is liable to be thus affected. The symptoms and treatment are similar. Females are the ordinary patients; hysterical, and of the neuralgic temperament. The head of the tibia is probably the part most frequently affected; and, not uncommonly, some slight injury is assigned as the originating cause.

If the pain should happen to be both great and fixed, limited abscess in the interior of the bone may be somewhat closely simulated. Diagnosis mainly rests on the constitutional indications, the character of the pain (p. 53), and the effect of tentative treatment.

Ostitis.

As already observed, periostitis cannot long exist, without the corresponding portion of bone being more or less involved. But, not unfrequently, the inflammatory process commences in the latter texture. It may affect only the external surface, or originate and exist chiefly in the interior, or involve the entire thickness; and accordingly is termed External, Internal, or General. Also, it may be either Acute or Chronic.

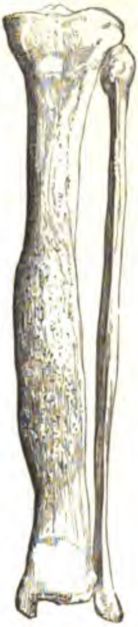
Like periostitis, it may be the result of external injury, or atmospheric exposure; or, the cause being constitutional, it may be termed idiopathic. Or the process may extend from the soft parts, involving both periosteum and bone secondarily; as is not unlikely to happen in many cases of neglected phlegmonous erysipelas. And again, no predisposing cause is found more frequent or certain in its operation than mercury; more especially if this have been both profusely and unnecessarily administered.

The result of the process may be Suppuration, internal, external, or general; Ulceration, simple or carious; local Death, or Necrosis. Or, the process not reaching true inflammation, and imperfectly resolving, there may be simply Change of Structure.

Change of Structure.

At first the bone is softened; apparently by absorption of part of the earthy matter. At the same time, its texture becomes more open; its surface presenting a porous appearance; as if the meshes of dilated vessels in the Haversian canals had pushed aside the softened parenchyma, to make freer space for themselves. The lamellæ are separated, the vascular canals widened, and the cells enlarged; new cells, too, are formed, by the dilated canals communicating with one another. And these, as well as the canals, come to be occupied by fibrinous exudation.

Fig. 114.



Porous enlargement of the tibia; the result of ostitis.

The process abiding short of true inflammation, the plastic deposit passes transitionally into bone. "This new bone is situated around the orifices of the canals, enclosing the processes which have been drawn out by sub-periosteal exudation; so that the surface of an inflamed bone presents numerous orifices of enlarged and open Haversian canals, with their lips more or less thickened or everted; the internal half of the convex edge, which bounds an orifice, belonging to its own lip, the other half to those of the neighboring canals. The inflamed surface is now slightly elevated by this new deposit of bone, the degree of elevation and the size of the canals being greatest at the centre of the inflaming spot." The bone is enlarged, but still porous and spongy in texture.

But as the process becomes more chronic, organization and transition of the deposit advance more thoroughly; and to enlargement are added both condensation and induration of texture. The osseous deposit is made on the inside of the Haversian canals; and, in consequence, these become narrowed, and may be ultimately obliterated; section of the bone presenting a dense ivory appearance (Fig. 116). The medullary tube, too, often is similarly encroached upon. And in consequence of this excess of earthy matter, it is important to bear in mind that the bone—now less vascular—is impaired in vital power; and therefore less likely to control a reaccession of the inflammatory process. Liability to suppuration, ulceration, and necrosis, is increased. This state of condensation may persist, but little changed. Or, by removal of the new deposit, the Haversian canals may again widen, and openness of texture be restored.

When the original process has completely subsided, we are not to expect the same rapid and satisfactory disappearance of structural change, as in similar affection of the soft parts. Yet absorption is not idle. The preternatural deposit diminishes more or less. And, if inflammatory relapse do not occur, after some time both enlargement and condensation may be considerably modified, and normal texture somewhat restored; more especially if the natural resolutive effort be judiciously seconded by appropriate treatment. Such resolution, however, can only be hoped for after a long time; and under any circumstances is seldom if ever altogether complete.

The progress of simple change of structure in bone is indicated by symptoms in the main very similar to those of periostitis. The pain is equally, if not more severe, and has also marked nocturnal exacerbations; it is more deeply seated, and not so much aggravated by pressure. The soft parts are early and much involved; but, at first at least, in a minor degree. In the deeper areolar tissue, exterior to the periosteum, and intermuscular, there is much fibrinous exudation; clogging the muscles, impeding motion, and affording a firm, deep, inelastic swelling. In the superficial areolar tissue, serum accumulates; occasioning more or less œdema. Us [illegible] kin too becomes red, somewhat stretched, and glistening. [illegible] tution sympathizes more or less; according to its susceptibility, and the intensity and duration of the disease.

Treatment is as for periostitis; actively antiphlogistic in the outset, in order, if possible, to arrest the progress at once; failing in this, then counter-irritant locally, alterative constitutionally. But at all times we must be ready to cease from counter-irritation, and resume antiphlogistics, should reaccession of acute disease threaten to supervene.

In the thoroughly chronic state of enlargement and condensation, no activity of treatment is either required or warranted. Time and rest are mainly trusted to; with general management, and the internal use of the iodide of potassium.

Suppuration of Bone.

External Abscess. 1. *Acute.*—We have already seen that, in acute periostitis, the subjacent bone is early involved in similar affection; that effusion takes place between; and that if the inflammatory crisis be reached, abscess there is inevitable. For such suppuration it is plainly immaterial, whether the process originate in the bone or in the periosteum; it soon extends by contiguity to both. Pain is excruciating, distinct rigors usually accompany the act of suppuration, swelling is considerable and increasing, and ultimately fluctuation may be discerned; at an early period the integument reddens and becomes painful, and the subcutaneous areolar tissue is infiltrated by serum. The progress of such an abscess has already been considered (p. 186); as also the treatment which is suitable. By early and direct incision only, can mischief be arrested and repair satisfactorily obtained. The matter is discharged; ulceration of bone ceases; and so soon as the inflammatory process has sufficiently subsided from its crisis, granulation begins from both hard and soft parts, and advances towards cicatrization. If incision be omitted, matter accumulates; tension increases, so does pain; and then comes aggravation of the original disease. Periosteum is separated from the bone, by lateral extension of the abscess; more and more weakening vital power in the denuded part. This, compressed by the pus—already inflamed, and with its power of controlling disease much impaired—readily yields before that pressure. It ulcerates, or may even perish in part by necrosis. And when the external opening and discharge of pus are at length effected, a large suppurated cavity, with ulcer of bone, necrosis, or both, must inevitably complicate the case very unfavorably, and must delay the cure; a complication and delay which it is in our power to avoid by early incision.

2. *Chronic.*—But the process may be altogether chronic and limited, and yet have reached to suppuration; and the abscess may be small, and chronic too—enlarging slowly if at all. In such a case we must be more chary of the knife. The bone's surface has been so gradually and gently subjected to pressure, that no ulceration has as yet occurred. Were a direct incision to be made, this must inevitably bring a certain amount of acute inflammatory accession as its direct result; and under this, ulceration or even partial death might be induced. Such risk, therefore, is not to be incurred. The practice, under the circumstances, is to attempt discussion by the means formerly detailed as suitable for absorption of minute chronic abscesses (p. 193). The matter is gradually taken back into the system; so gradually as not to affect that injuriously. The cavity proportionally contracts; and the bone recovers its normal state, without having sustained solution of its continuity, or been ever threatened with exfoliation. Failing in discussion, or from any cause acute accession having supervened, then direct, free, and early incision is to be practised unhesitatingly; as undoubtedly the less of two evils.

Superficial abscess of bone, when large, is seldom chronic; but, if such should occur, the same treatment is advisable as for chronic abscess in general; namely, subcutaneous evacuation by a valvular aperture, carefully excluding atmospheric air (p. 195).

Chronic abscesses on the surface of bone are often connected with the syphilitic, or mercurio-syphilitic cachexy. These might seem to be peculiarly unpromising; but they are not. Even when the bone is obviously rough and spongy, incision is to be abstained from; and under full and sustained doses of iodide of potassium internally, with the external use of discutients, rapid and permanent cure may often be obtained.

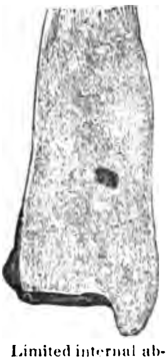
Internal Abscess.—This may be either Diffuse or Limited. 1. *Diffuse.*—Inflammation has reached the suppurative crisis in the lining membrane of the interior of a bone, and in the vascular meshes of connection between that and the periosteum; and there is no fibrinous accompaniment, of limiting capability. The pus, so soon as formed, is infiltrated into the cancellous texture; which—like areolar tissue of soft parts similarly situated—gives way, and is broken up by ulceration and sloughing. Partly by such destruction of texture, from within outwards; partly by the passage of pus outwards, through foramina and canals; partly by the extension of suppuration from within to the exterior—matter is sooner or later formed beneath the periosteum, and ultimately also in the more superficial soft textures; but, as can be readily imagined, not till after some time, much agony, great swelling, and serious constitutional disturbance. The fate of bone, under such circumstances, is inevitably untoward. It must fall a prey to ulcer, necrosis, or both; and that extensively.

The treatment is to make a free direct incision, so soon as the presence of matter can be ascertained. The pus and disintegrated debris of the cancellous texture are discharged; further extension of mischief is probably prevented; and an opportunity is procured, favorable for extrusion of dead parts, and for otherwise remedying the disaster already sustained. Constitutional antiphlogistics are at the same time employed; proportioned to the symptoms. If progress towards cure be slow, discharge copious, and natural power of system weak, hectic is not improbable; and the general remedies must change accordingly.

2. *Limited Internal Abscess.*—The occurrence of this is more rare. The cancellous texture of the heads of the long bones—more especially of the tibia—is the ordinary site. The patient is at or beyond the middle age; and generally has [illegible] exposed to inclemency of weather, particularly during nig[illegible]bscess is minute, the suppurated part seldom exceeding the space of a shilling in extent; and it is surrounded and limited by fibrinous deposit, which has made full transition into the osseous state. On making a section of the part, the suppurated space is seen bounded by dense recently formed bone; and is usually lined by a distinct pyogenic membrane.

The texture around becomes affected by ostitis, of a minor grade; causing gradual enlargement, and ultimate consolidation, of the whole bone at that part. The primary affection is also, no doubt, of a low grade; and, as such, continues for some time; attended by exudation of a plastic character, which becomes organized and transformed. But in the centre of the so inflaming part, as usual, increase in the inflammatory process occurs; the suppurative crisis is reached there; and the matter, when secreted, is limited and confined by the condensed bone just formed. This barrier serves both a good and an injurious end. It is plainly analogous to the limiting fibrinous exudation in abscess of the soft parts; but it is not alike salutary. For while it protects the surrounding parts from purulent infiltration and consequent disruption, it also prevents, from its density of nature, anything like accommodating expansion before the accumulating pus; increasing greatly the pain and constitutional affection, and tending to aggravation of the original disorder. Unless relief be afforded, a more formidable inflammation will invade the whole affected part; inducing ulceration and necrosis, more or less destructive, with proportional aggravation of constitutional disorder.

Fig. 115.



Limited internal abscess in lower part of tibia. Section of bone. Prep. in Royal College of Surgeons' Museum.

Sometimes the suppurative crisis is not preceded by a persistent minor grade of the inflammatory process; and, in such cases, there is little surrounding condensation; indeed such barrier may be scarcely appreciable. Tendency to diffusion is consequently great; rendering the progress of the case less protracted, but not less destructive.

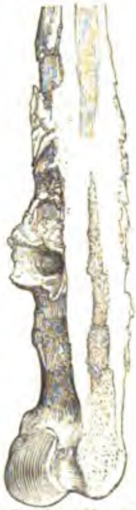
In any case, it is not to be supposed that the limited condition of the abscess is prone to long continuance. The tendency is otherwise; to diffusion. Suppurative inflammation having taken place around, the characters of limitation are quickly swept away; and the limited is merged in the diffuse and more frequent form. At the same time, if inflammatory accession remains aloof, the limited form may endure for many months; slowly enlarging, perhaps, and becoming more and more densely surrounded by new osseous deposit.

If closely situated to a joint, there is a risk of its progress causing purulent irruption into the cavity; intense synovitis resulting—usually destructive.

The symptoms of this affection are very marked. Excruciating pain, constant, and rather on the increase that otherwise, is felt in one fixed spot, of limited extent. At that point the skin is red, but not tense; and only slightly swollen, if at all. Some increase of pain results from firm pressure; but such increase is infinitely below what would accrue, from direct compression of a part primarily inflamed. The superficial bone and soft textures have become involved in a minor grade of the inflammatory process; and it is from compression of these that aggravation of the pain occurs. As usual, nocturnal exacerbation is present. A sensation of weight and throbbing, as well as of great pain, is felt and complained of by the patient, in the centre of the bone; and to that spot, on which he can at once lay his finger, he unhesitatingly attributes all his affliction. No ordinary antiphlogistic treatment, however active, affords relief. Constitutional disturbance is decided, and is at first of the inflammatory type; sleep is almost wholly denied; and not unfrequently delirium occurs. By continuance, the powers of the system are gradually exhausted; the fever consequently changes to the hectic type; and this may prove so urgent as to demand amputation. More than one mutilation has been performed above the knee, which should have never happened; seeing that perforation of the head of the tibia, and evacuation of a small abscess there, would have sufficed to resolve all the urgency.

Sometimes remarkable intermission of the symptoms occurs, in the more chronic cases; probably in consequence of the matter having found either a partial or complete vent from its original site. When such intermission does take place, the case may closely simulate neuralgia (p. 342).

Fig. 116.



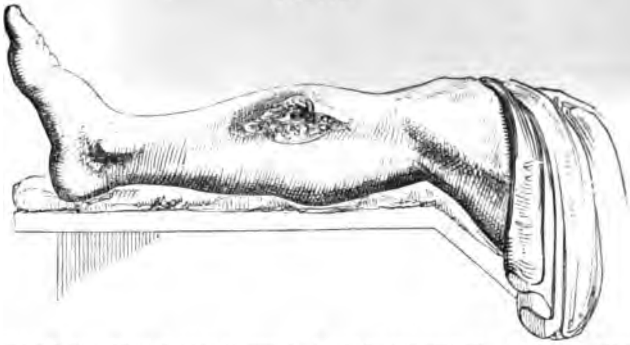
Section of femur, showing great condensation. Near the middle, an abscess has discharged itself, at some remote period — not, however, before having proved the cause of extensive structural change.

It has been already observed, that usually, unless efficient relief be afforded, aggravation and extension of the original affection occur; involving the whole bone at that part in suppuration, ulceration, and death. Sometimes, however, the progress is more gradual. Absorption and ulceration occur in the parts surrounding the abscess; this slowly enlarges, and obeying the general law, enlarges chiefly towards the surface; the surface is ultimately reached, the matter discharged, and the bone relieved. Not unfrequently, one or two small sequestra are extruded along with the matter. But this is both a painful and protracted process; occupying not days, but weeks; and ever liable to be merged in general inflammation and death of the bone. Even supposing that such accession do not occur, constitutional disorder will be inevitably great and, in consequence, life may be endangered, or saved only at the cos of the limb. And, at the best, the aperture which evacuates the absces remains a permanent cloaca; the internal cavity may not wholly close the thickened and expanded bone may not recover; and deformity of n inconsiderable degree consequently remains.

Sometimes the abscess seems to continue but little altered from i original state; having abandoned all acuteness of character, shortly aft its first formation; yet occasioning symptoms of a serious kind, bo generally and locally. On opening such a cavity its pyogenic mem brane is found unusually vascula [illegible] distinct.

Treatment is simple. Instead of the amputating knife and sa at an advanced period of the case, we employ the scalpel and tr phine at the beginning. Ordinary means having failed to arre the inflammatory process, and the symptoms being sufficiently pla to convince us that a limited internal abscess has formed, we ma a free incision over the marked spot; and there apply the crown a trephine; perforating towards the interior. On reaching the canc

Fig. 117.



Internal abscess affecting the tibia, near its centre. Cured by the trephine. Patient a policeman, æt. Case narrated in Liston's "Elements," p. 177.

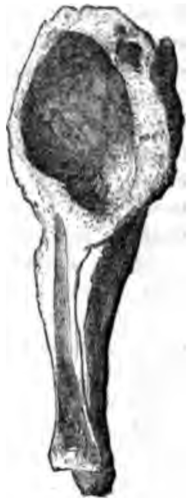
lous texture, pus will probably begin to ooze by the side of the instr ment. In withdrawing the trephine, along with the laminated porti of bone which it has detached, a tea-spoonful or two of tolerably laudab pus may escape; and then, evacuation having been fully accomplish the patient passes almost at once from most cruel torment into plac repose. The flaps are replaced, and the wound treated on ordinar principles. All inordinate excitement quickly subsides; and the pa ultimately cicatrizes, firmly and permanently.

Should the first trephining fail to detect pus, and the symptoms be most convincing of its presence, the instrument is to be reapplie with hopes of a better success—as is well exemplified in a case deta in Liston's "Elements," p. 116.

By such comparatively simple procedure, both life and limb ma saved; an important fact; for which our profession stands indebted Sir Benjamin Brodie.

Chronic Internal Abscess.—This may result from the acute; the inflammatory process subsiding, no primary osseous barrier of limitation existing, and pus continuing to be formed not more rapidly than the surrounding parts can accommodate themselves to by expansion. Or the inflammatory process is chronic throughout. The laminated texture is gradually distended; and the cancellous is either condensed, assisting to form the parietes of the cavity; or is removed by absorption, ulceration, or both. Sometimes small dead portions become detached, and mingle with the fluid contents. The cavity steadily enlarges. Its contents are purulent, but usually thin; commingled with the ulcerative debris, and, as just observed, often containing small sequestra. A distinct pyogenic membrane lines the interior; and the walls consist of the expanded laminæ of the bone, strengthened from time to time by recent osseous deposit. On making a section of bone so affected, its laminated portion is sometimes found, notwithstanding much expansion, considerably thicker and more dense than in the normal state. At one point, however, attenuation of the parietes does take place, though very slowly: and there ultimately discharge may be effected.

Fig. 118.



Chronic Abscess of Tibia — of large size. Bone much thickened as well as expanded round the cavity. Prep. in Royal College of Surgeons' Museum.

The symptoms are like the morbid process, of a chronic nature throughout. A dull indolent swelling forms gradually; with more or less affection of the superimposed soft parts, and irritation of the system.

Treatment consists in perforation of the parietes, at the prominent and thinnest part. A bistoury may be sufficient for this alone; or the assistance of a small trephine may be required. The purulent contents are thus evacuated; and an efficient draining of them is insured, by establishing a second and more dependent aperture, if necessary. Granulation and repair advance in the interior; by uniform support externally, from bandaging, centripetal contraction of the parietes is favored; and thus slowly the cavity may fill up, the discharge ceases, the swelling in some measure subside; and both symmetry and usefulness may be at least partially restored. But not unfrequently, as can readily be imagined, progress towards cure is interrupted; the part threatening to remain open, from failure of reparative power. In such circumstances, stimulation of the interior by injections, as of sulphate of zinc, is likely to prove beneficial. And if these fail, a seton may be lodged temporarily, so as to arouse a fibrin-bringing process there; which, on subsidence of the true inflammation, may carry on repair with a renewed and more successful energy. If the cavity be large, and its parietes thin and superficial, the process of cure may be abbreviated by removing a part of these, and then dressing the wound so as to insure contraction and filling up from the bottom.

There is an affection of bone, termed *Osteocystoma*, in some respects resembling chronic internal abscess; by the ancients supposed to be of a windy character, and hence, improperly, called *Spina Ventosa.* Usually it is classified with tumors of bone; and may be considered analogous to the encysted tumor of soft parts. A membranous cyst forms in the interior of a bone, causing equable expansion of the laminæ; and forming a cavity occupied by a fluid, sometimes puriform, sometimes clear and glairy. The parietes, as the cavity slowly enlarges, are more and more attenuated; at some points they become membranous, and ultimately the membrane may give way. No osseous deposit accompanies the dilatation, as in chronic abscess; for the morbid process is from the first non-inflammatory. The cavity is lined by a membrane, more of a serous than of a pyogenic character: and sometimes membranous septa subdivide the space, as in multilocular serous cysts.

The distinctive characters of the swelling thus are:—the contents seldom, if ever, truly purulent; the parietes simply expanded, and consequently attenuated; the formation neither preceded nor accompanied by inflammatory change; commencing in the cancellated interior, by non-inflammatory formation of a cyst, which partakes largely of the serous character.

Treatment is similar to that of chronic abscess; puncture, satisfactory evacuation, external support, internal stimulation if necessary. Partial ablation of the external wall may sometimes be expedient, as in abscess; and sometimes entire removal is no improper practice. For example, the affection is not unfrequent in the phalanges of the fingers; and if one of these be wholly expanded into a large cyst, it is prudent at once to amputate that phalanx, instead of attempting a protracted, under such circumstances certainly imperfect, and probably abortive cure by incision.

Scrofulous, or Tubercular Abscess of Bone.—This is of indolent and chronic origin; liable to acute exacerbation. It is situated in the cancellous texture; in the bodies of the short bones, or in the articulating extremities of the long ones. The bone having become expanded, congested, and deprived of much of its earthy matter, so as to be soft and compressible, deposit of tubercular matter takes place in the cancelli; either by perversion of simple nutrition, or accompanied by a low grade of the inflammatory process. Such deposit having accumulated in some quantity, asthenic inflammation supervenes; spontaneously, or by external injury. The tubercle crumbles down, and becomes mixed with a non-laudable purulent fluid. And this matter may be either limited by a pyogenic membrane, or become diffused by infiltration; most frequently, the abscess is of the diffuse character. According to the site, either the general surface is approached, and the tubercular debris, with pus, thence discharged; or the neighboring articular cavity is opened into, and by such irruption grave inflammation is excited therein. But neither of these events, it is plain, can occur, without serious injury having been first done to the cancellous texture in which the abcess originated.

The symptoms are, first, uneasiness and weight, rather than pain, deeply seated in the bone, increased somewhat by pressure and considerably by motion; and occurring in a patient of an obviously strumous habit. Enlargement of the bone then takes place at that part, with increase of the uneasy sensations; the superimposed soft parts become œdematous, and the skin assumes a bluish color. On occurrence of the suppurative crisis, enlargement becomes more rapid; pain increases, but yet is comparatively dull; shivering takes place, and the system thereafter sympathizes more or less. When the surface is approached, fluctuation and pointing may present themselves, unless incision be premised; and an opening having formed, the usual characters of the scrofulous sore are exhibited, with the addition of a foul ulcer of bone at the bottom of the cavity. When, on the other hand, an articulation is opened into, violent aggravation of both local and constitutional symptoms follow; as will be afterwards described.

Sometimes, but very rarely, the tubercular deposit, instead of undergoing inflammatory degeneration, may become changed into a mass of earthy matter; as more frequently happens to tubercle in the lungs.

Treatment should be mainly prophylactic. By rest, fomentation, and attention to the general health, it is our object to limit tubercular deposit, and delay its suppuration. Leeching, or other antiphlogistics, injure the system; and counter-irritants, of any high grade, in addition to a similarly evil effect, often seem to hurry onward the local disease. The best remedies are general hygiene, with sea-air, cod-liver oil, and chalybeates; the iodides, also, being sometimes well borne. When suppuration has occurred, we have little or no power of controlling the untoward progress. All that we can do is to evacuate matter by incision, so soon as its presence has been detected—seldom until it has appeared in some quantity in the soft tissues; mitigating, meanwhile, as we best may, both local and general symptoms, as they arise.

When, under scrofulous disease, bone has been destroyed, reproduction seldom if ever occurs. And hence, in scrofulous loss of substance, so common in the phalanges of the fingers in young people, shortening of the fingers inevitably results; proportioned to the amount of bone destroyed.

General Suppuration of Bone.—The abscess is neither external nor internal, but diffuse, pervading the whole thickness of the bone, and invariably acute; the result of intense general ostitis. The bone, or portion of bone, so affected, usually dies; and is bathed in a profuse secretion of pus, which not only burrows under the periosteum, but lodges also in the general soft parts, ultimately, nay rapidly, making its way to the surface. In fact, the case is one of acute necrosis.

The ordinary symptoms are, shivering; violent, deep-seated pain, constant, and increasing; great swelling of the limb, obviously of inflammatory origin; redness of the integument, as if erysipelatous; constitutional disorder, severe, and of the sthenic inflammatory type. Matter forms, and is discernible in the soft parts; deep, in contact with the bone.

It approaches the surface at one or more points, and is discharged by either an artificial or spontaneous aperture. Soon thereafter, the inflammatory fever may pass into hectic. The acute stage—abscess—has gone by; the chronic stage—necrosis—has become established.

Treatment consists in active and early antiphlogistics, both general and local, in order to prevent suppuration. When matter has formed, early and free incision is required; not to prevent necrosis—for that is impossible—but to limit its extent, and favor the natural process of cure.

Absorption of Bone.

This is more or less connected with the inflammatory process, but altogether independent of true inflammation.

1. *Interstitial.*—By interstitial absorption affecting the whole of a bone, Atrophy is produced, as already noted (p. 369). But perhaps a more important surgical affection is interstitial absorption affecting a part of a bone; converting its dense laminated portion into a cancellated texture, and ultimately imparting to its surface a worm-eaten appearance (Figs. 50, 51, p. 259). This is a s[illegible]ious process; non-inflammatory; obscurely marked by dull uneasiness or aching in the part, œdema of the superimposed soft tissues, and lividity by passive congestion of the integument. The part feels weak; when used, it becomes soon the seat of pain as well as of fatigue, and at the same time the swelling is increased.

In itself the change is important, as entailing alteration of structure, and impairment of function. But it derives its chief interest from being the precursor of a much more formidable disease—Caries. The cranium and metacarpal bones are often so affected.

Treatment consists in attention to the general health, rest, and counter-irritation; the last gentle, but perseveringly maintained until the symptoms have satisfactorily disappeared. And then a roborant and soothing plaster may be worn for some time with advantage; as the emplastrum opiatum, spread on thick leather. Among medicines, the cod-liver oil and iodide of iron are specially useful.

2. *Continuous.*—This is the result of pressure; sufficient to stimulate absorption to an increased, and probably perverted function; but not intense enough to rouse the bloodvessels to assumption of inflammation. There is gradual loss of substance; and so a cavity may be formed in the bone, even to a large extent, slowly, and almost without pain. After death, it may seem the result of ordinary ulceration; but pathologically it differs widely from this. There is no inflammation, no formation of pus, no crumbling down and solution of the particles: in short, there is no true ulceration, nor any of the symptoms which ordinarily accompany and indicate this inflammatory product. For the maintenance of such simple structural change, exclusion of atmospheric influence is essential. Admit air, and inflammation is the certain result; the additional stimulus acting untowardly on a part which, by previous change, is already greatly predisposed to disease. Pain and rapid destruction of texture supervene, by ulceration; and purulent fluid is thrown out in abundance.

Examples of continuous absorption are afforded in gradual compression of bone from aneurism, chronic abscess, or solid tumors—slowly enlargeing (p. 260). The affection may persist, of its original and simple nature; more frequently it becomes merged in the more rapid destruction of true ulceration. All that is necessary to such supervention is external injury, admission of atmospheric influence, or sudden increase of the compression.

There is but one mode of treatment—removal of the cause; as by evacuation of the abscess, cure of the aneurism, excision or discussion of the solid tumor.

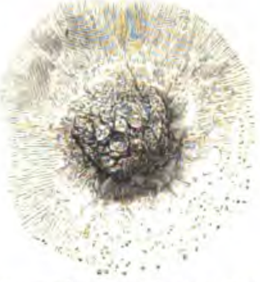
Ulceration of Bone.

This may be simple and tractable—*Ulcer;* or peculiar, and difficult of cure—*Caries.*

1. *Simple Ulcer* of bone is the product of true inflammation; as in the analogous condition of the soft tissues. Inflammation is invariably its direct cause; often pressure is the inducing, but more intensely and suddenly applied than in the production of continuous absorption; and although atmospheric influence is not essential, still it is very favorable to the process. As a soft texture may inflame, suppurate, and ulcerate, so may bone; the inflammatory process originating in and being mainly limited to the ulcerated part. Not unfrequently, however, the site of ulcer is not that which is primarily, but that which is secondarily involved. Abscess, occurring either by ostitis, or by inflammation of soft textures in the immediate vicinity, compresses a portion of bone not originally inflamed, and so induces its molecular destruction. Such pressure may come from without or from within; the abscess may form in the soft tissues, and cause ulceration in the surface of the bone; or suppurative ostitis having occurred in the cancellated interior, and the pus making its way outwards by ulceration, in obedience to the general law, a chasm in the bone necessarily results.

The destructive process is simple, like its analogue in the soft textures. So long as pressure and inflammation continue, ulceration advances with more or less rapidity; but, on their removal, it also ceases, and the process of repair succeeds. The healing process is not entirely similar, however, as can readily be supposed. There is formation of new matter, as in the healing ulcer of soft parts; and this new matter is converted into bone, constituting what may be termed osseous granulations. By these the surface of the healing sore is more or less copiously studded; but the supply of such new material is far from being so abundant as in the cutaneous sore. And the surrounding bone, being an inelastic texture, does little towards diminution of the chasm by centripetal movement. Something, however, is effected by absorption. While the excavated surface is scantily throwing out new osseous matter, interstitial absorption is advancing in the margins, which are, as it were, bevelled off thereby; and, ceasing to be abrupt, they slope gradually towards the central depression. Thus, partly from elevation of the excavated surface by reparation, partly from levelling of the surrounding margins by absorption, the cavity comes to be gradually diminished; and the superimposed soft parts, meanwhile busy in bringing themselves into a state suited to granulating repair, now coalesce with the osseous granules beneath, and interweave hard texture

Fig. 119.



Ulcer of cranium, healed. The margins bevelled off, and sloping down. The surface studded with imperfect granulation. From the same cranium as Figs. 50, 51.

with soft, into a fibrous substance; which, ultimately skinning over, gives a firm, depressed, solid, white, permanent cicatrix.

Sometimes the soft parts heal by themselves, independently of the bone; filming over, while the ulcer beneath is yet unclosed. The cicatrix then is elevated, movable, evidently unconnected with the bone, livid, soft, and painful; certain soon to be undone, by reaccession of inflammation; disclosing the ulcer beneath, perhaps wider and deeper than before.

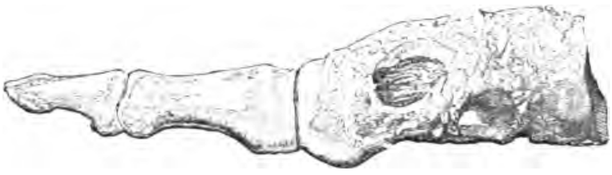
Ulcer of bone, though originally simple, and well-disposed to heal, may, from its extent, or by reaccession of inflammation and ulceration—and consequent vacillation in its progress—degenerate into a weak or indolent condition, tardy and inefficient in repair; as happens, under similar circumstances, in the soft parts.

Treatment is conducted on principles precisely similar to those which regulate that of the cutaneous sore. Rest, water-dressing, and antiphlogistic regimen, during the inflammatory and ulcerative stages; not forgetting removal of any obvious cause at the outset; then water-dressing, medicated so as to gently stimulate; external support by uniform bandaging; and maintenance of the *vis vitæ* by suitable regimen, so as to insure activity of repair.

2. *Caries.*—This may follow on the simple sore. More frequently it is original. It is something more than a weak ulcer of bone; it is something less than a malignant or cancerous sore, as it is sometimes designated. With many, there is a culpable laxity in the use of this term; applying it indiscriminately to all breaches of continuity in bone, of whatever kind. We shall endeavor to define the state of matters to which the term caries is truly applicable, and shall use that word only to denote that condition; remembering the just saying of Mr. Pott, how "clear and precise definitions of disease, and the application of such names to them as are expressive of their true nature, are of more consequence than they are generally imagined to be. Untrue and imperfect ones occasion false ideas, and false ideas are generally followed by erroneous practice."

Caries is a breach of continuity in bone, of an altogether peculiar kind; of itself almost incapable of cure, yet not in any degree partaking of true malignancy. In dense bones, it is preceded and accompanied by interstitial absorption, as formerly observed (pp. 259, 380); cancellated texture seeming to be its proper nidus; and degeneration of laminated bone into this state seeming to be essential to its accession,

Fig. 120.



Example of Caries in the metatarsal bone of the great toe. Two carious ulcers; each surrounded by interstitial absorption; as well as by attempts at reparative effort.

in those parts where cancellous texture does not naturally exist. The margins of the cavity, consequently, have not the abrupt and firm character of the simple ulcer; but are soft, spongy, and worm-eaten in appearance. The surface of the cavity is sometimes of a uniform level; more frequently it is unequal; deep at one point, and comparatively shallow at another. It has no adequate power of reparation. It is either open and uncovered; as if either inanimate, or still undergoing disintegration—a probe passing crumblingly into it, as into soft decayed woody fibre. Or it is invested by tall, pale, fleshy granulations; which seem altogether incapable of completing transition into bone. The ulcerative process is rather chronic than acute. Sometimes the bone is extensively and rapidly destroyed; more commonly, destruction is slow and gradual, even when great. Not unfrequently only a slight extent of the bone's surface is involved; even in cases of old standing. The whole of a small bone, even the whole of a chain of small bones, or all the articulating extremity of a long bone, may be attacked; or a thin external portion alone may suffer. A thin, fetid, purulent discharge, often bloody, always acrid, usually more or less mixed with ulcerative debris, and often containing small detached sequestra, exudes in considerable quantity. The corresponding soft parts are swollen by infiltration, and broken up by suppuration; and one or more apertures exist in the integument, presenting the characters sometimes of the weak, sometimes of the scrofulous, sometimes of the irritable, sometimes of the inflamed ulcer. A probe, passed through these apertures, reaches the bone, and is found to sink into it; readily, with the application of little or no pressure, if the surface be uncovered by soft parts; but not without pressure, if investing firm granulations exist, as very frequently is the case. In using the probe, this must be borne in mind; otherwise, fallacy of diagnosis is not unlikely to be incurred. Sometimes the probe may be freely used, and little pain ensue; but more frequently even its lightest movement causes much suffering, and considerable hemorrhage of a dark oozy nature; both pain and bleeding being due to the soft parts, rather than to the bone. Usually there is smart pain in the part, even independently of external interference.

The diseased portion may be conveniently considered as consisting—often, though not invariably—of three parts; the central, the ulcerous cavity; a circle exterior to this, affected by interstitial absorption; a third, beyond, consisting of comparatively sound bone, undergoing a low grade of the inflammatory process of the sthenic character. The two interior portions are incapable of efficient reproduction or repair; the external is busy, as it were, atoning for their deficiency by throwing out new osseous matter, sometimes in great abundance. Thus the carious cavity is surrounded, first by spongy worm-eaten bone; and more exteriorly by osseous spicula or granules forming a hard irregular ridge, sometimes but slight, at other times extensive. It is not meant that such is the arrangement in all cases, but only in the majority; in some the ulcerous margin terminates abruptly on the region of osseous repair. Sometimes necrosis is engrafted on the ulcerative process; and in the cavity may be found dead portions, either of cancellated or laminated texture; partially adherent, or altogether loose as sequestra.

The system invariably suffers to a greater or less extent; and the disorder is of the asthenic type—constitutional irritation. Very often the patient has been for some time manifestly cachectic, previously to accession of the local mischief. If not, symptoms of a hectic character are not long in supervening; all the more early and formidable, if the caries implicate an important articulation.

Fig. 121.

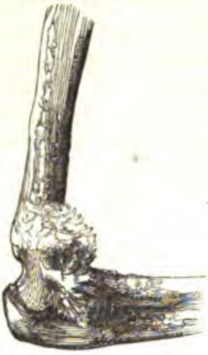


Fig. 122.

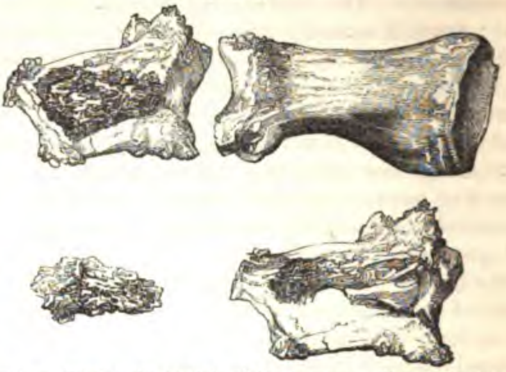


Fig. 121. Caries of the elbow; mainly affecting the condyle of the humerus. The vegetative effort around the carious surface well exemplified.

Fig. 122. Necrosis and Caries combined; in phalanges of the toes. In the upper, the carious cavity represented still containing its sequestrum. In the lower the cavity and sequestrum separate.

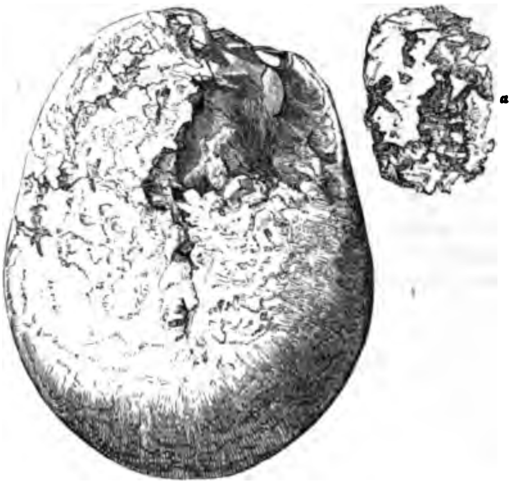
Caries may be *Simple*, as just described; or it may be of a *Scrofulous* or *Tubercular* character. In the former case, it is unattended by any peculiar deposit. In the latter it is often both preceded and accompanied by deposit of tubercle in the loose texture of the bone; originating, in fact, in the morbid condition formerly detailed as constituting scrofulous abscess of bone (p. 378). First, there is tubercular infiltration of open texture, either originally cancellous or rendered so by interstitial absorption; then disintegration and suppuration of this. From the ultimately open condition of the abscess, the state of ulcer necessarily results; and the cavity of the ulcer is more or less occupied with tubercular masses of a lardaceous character. The soft parts present the usual appearances of a scrofulous sore; and the system, both before and during the progress of the local disease, shows the ordinary signs of strumous cachexy; latterly aggravated by more or less of hectic. During the suppurative stage, irritative fever is not unlikely to be present.

Causes.—As already stated, the disease may be primary or secondary, an originally simple ulcer having so degenerated. Sometimes the bone is not the texture first involved. Infiltration and suppuration, tubercular or not, may have occurred in the soft textures; and thence disease may have extended to the neighboring bone. Or an intractable ulcer of the soft parts may come to implicate the subjacent osseous structure, as in lupus.

By some, the affection of bone which follows on the truly malignant ulcer or tumor of soft parts is termed caries; but unjustly. It is a truly malignant or cancerous ulcer; just as different from true caries, as cancer is from a simply weak or irritable sore.

In the tubercular caries, scrofula is of course to be considered as the predisposing cause; any slight external injury may serve for the exciting. Syphilis may induce caries of the cranial and other bones; the poison often seeming to enact the part of both predisposing and exciting cause. And the same may be said of mercury; perhaps with greater truth—at least in those cases in which that mineral has been given both sakelessly, and in profusion. An unfortunate conjunction of the two poisons, mercurial and venereal, in a scrofulous system, is the parent of the worst, and not least frequent forms of the disease.

Fig. 123.



Mercurio-Syphilitic Caries of the Skull. *a*, A portion detached, in the form of sequestrum.

Treatment.—Prevention is obviously the paramount indication. With this view, if symptoms of interstitial absorption be present, our attention will be directed to the arrest of this; by rest, counter-irritation, and constitutional care. If a simple abscess or ulcer occur on the surface of bone, it will be our object to effect the healing of this as rapidly as possible; in order to prevent degeneration. When mere ostitis is present and demands our aid, we shall treat it actively yet warily; actively, in order to arrest the inflammatory process, ere yet the untoward results of suppuration or ulceration have occurred; warily, avoiding exhaustion of the system, and still more the poisoning of it, by excess of mercurial and other active antiphlogistics; careful not to induce a state favorable to the occurrence of destruction in bone. And seeing that caries is usually so much connected with taint of the system, our attention will be throughout directed towards constitutional care in connection with both prevention and cure.

When caries has occurred, the indications of local treatment are abundantly simple. We are to take away the two portions which are incapable of healthy effort—the interstitially absorbed, as well as the truly ulcerous; leaving a solid foundation of normal texture, not only capable of, but already engaged in, the business of efficient repair. Afterwards, the part is to be treated as a simple ulcer; our anxious care being directed to speedy yet efficient and certain closure, lest renewed degeneration supervene. Not resting satisfied with a blue, elevated, soft, and spongy cicatrix; but insisting on the establishment of one which is firm, white, depressed—plainly incorporated with the bone (p. 382).

For effecting the removal, cutting instruments are infinitely preferable to escharotics; in all situations where excision is practicable. But, as a general rule, no operation of any kind should be performed on the bone, unless the adjacent and superimposed soft parts are in a quiet state. They may be undergoing the acute inflammatory process; they may be the seat of acute suppuration, of acute ulceration, or of both; and removal of a portion of bone, imbedded in such soft parts, is almost certain not only to prove futile as a means of cure, but actually to aggravate and extend disease. The then carious portion of bone may be taken away; but ulceration, instead of reparation, is certain to ensue; and by rapid degeneration the carious condition is renewed. Or a more intense and general ostitis is kindled; and the partial caries is merged in general necrosis. And even supposing none of these untoward events to occur, still the time of operation were inexpedient; as causing an unnecessary and therefore an unwarrantable amount of secondary inflammation.

The soft parts being already quiet, or having become so under suitable treatment, free incision is made through them; so as effectually to expose the diseased portion of bone—previously tolerably well explored by judicious use of the probe. The extent of the doomed parts having been satisfactorily ascertained, their thorough removal is then to be accomplished; by the saw, trephine, bone-pliers, or gouge, as circumstances may render expedient. As a general rule, the saw is preferred to the pliers; just as, in soft parts, the knife is preferred to scissors. A cleaner wound is made; there is less bruising; and, therefore, untoward inflammation is less likely to supervene in the line of wound. The articulating extremity of a long bone may be readily taken away by the common saw or by a smaller or straight-edged instrument. In a flat bone, such as the cranium or scapula, the trephine may be more convenient. And in many situations, where either the previously mentioned instruments are inapplicable, or when by them we have already taken away much but cannot remove all, our object may be gained by an instrument closely resembling the carpenter's gouge; firm, well tempered, and of a sharp edge; used lightly, so as not to crush but cut; and yet used determinedly, so as to insure ablation of all the texture prone to renewal of ulceration, and incapable of repair.

Fig. 125.

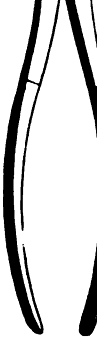


Fig. 124.

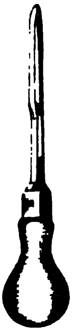


Fig. 124. Gouge. Suitable for effectually removing the carious texture. Fig. 125. Cutting bone-pliers; commonly called Liston's forceps; shut; for dividing the diseased bone—as in resection of carious joints.

Escharotics in some cases are employed; as for example, when the patient resolutely objects to any other mode of removal. Or when cutting instruments have been used, and yet a border of suspicious character remains, the extinction of such a suspected part may sometimes be conveniently enough intrusted to cauterization. The actual cautery may be applied; but unwisely. It effects too much. The carious part is at once and satisfactorily killed; but, as in all severe burns, the texture immediately surrounding the eschar, though escaping with life, has its vitality very much impaired, and is more prone to disintegration than repair. The potential cautery is infinitely preferable. It destroys the diseased part just as effectually, though perhaps with less rapidity; and at the same time the immediately adjoining parts do not in anywise suffer, but at once institute a healthful line of demarcation for removal of the dead part, and are well able to commence at the same time a sthenic process of repair. The preferable forms of potential escharotic are the red precipitate of mercury in powder, and the chloride of zinc made into a paste; the latter is the more generally useful. Application is made with intensity deemed sufficient to insure death of all the suspected part; and the escharotic is then removed. The whole wound is filled gently with lint; and such dressing is continued, covered perhaps by a poultice to mitigate vascular excitement until separation of the eschar has occurred. The bone's surface is then treated as a simple ulcer; with two paramount objects in view—speedy healing of the sore, so as to obviate degeneration; and a healing from the bottom, so as to insure the attainment of a permanent and healthy cicatrix.

Certain parts of the skeleton are liable to caries, and not accessible to either knife or caustics; as the knee and hip-joints, and the bodies of the vertebræ more especially. In these, the main reliance for cure must be placed in Nature; the surgeon is qualified only to assist. But as, under such circumstances, ordinary indications of cure cannot be carried out—or at least can only be slowly and imperfectly fulfilled—prognosis is unfavorable. It is still essential that the carious surface shall be thrown off, and a healthy foundation for repair obtained. This can only be accomplished by an effort of the part itself; by ulceration crumbling down the carious and unnaturally cancellated part,

Fig. 126.

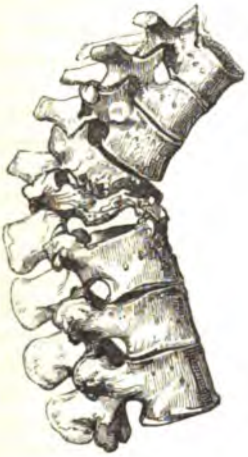


Fig. 127.

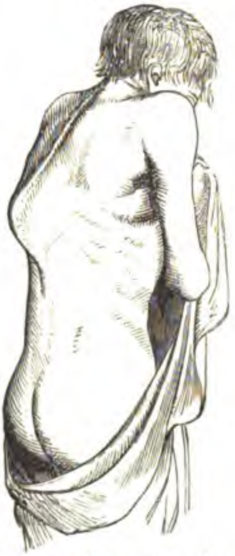
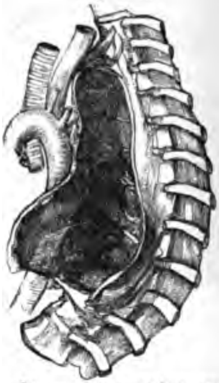


Fig. 126. Caries of the vertebræ; macerated; the bodies extensively destroyed; marked incurvation forwards. Fig. 127. The same during life.

and leaving the surrounding normal texture unattacked; ceasing wh it comes there, its task having been accomplished, and giving place the reparative effort already there begun. Or ulceration may be acc lerated, or at all events mixed up with more co tinuous death of the unprofitable part—necrosis

Fig. 128.



Caries of the vertebræ; previously to maceration. The aorta overlays the cyst of the abscess.

Such destructive process, especially that simple ulceration, may advance leisurely a quietly; without any communication with t external atmosphere. One of two events m then occu The skin may continue unbroke the purul tter becoming absorbed, as w as the mo debris of the bone which is th commingl h it; and this, it is plain, c only happen when the disease is of limited e tent, and the process altogether chronic in its n ture. Or the abscess with its contained debr and perhaps sequestra finds its way to the su face in the usual manner; and is thence d charged. It is in the early open condition th the process is likely to advance most favorabl atmospheric influence being favorable to acute- and consequently efficient—ulceration; while, the same time, a ready exit is obtained for the useless, and otherwi fast accumulating discharge.

The auxiliary treatment afforded by our art, in suspected disease these inaccessible parts, is in the first place to prevent occurrence true caries if possible, by attention to the general health, rest of t part, and counter-irritation. When caries has doubtless begun, and t process is slow, as well as the apparent extent of disease limited, we little more than abide the working of Nature; watching over the gene health, and maintaining for the affected part a complete immunity fr motion. We hope that disintegration will prove but slight, and openi of the surface be unnecessary; that the ulcer, freed from its carious s face, may simply cicatrize; or, inosculating with an opposed part in l condition, may effect a compromised cure by anchylosis. When t diseased surface is obviously large; when, in consequence, suppurati must be profuse, and the destructive ulceration extensive and sustain —we cannot too soon effect an aperture of communication with t exterior. This will expedite ulceration; abridging the process of d struction, as well as rendering it more likely to effect the object in vie at the same time permitting free evacuation of the suppurative a ulcerative results. We keep such a wound open and dependent; t inflammatory process which necessarily follows on its infliction anxiously watch, and if necessary subdue; while the powers of t general system are husbanded and maintained.

absorption, changing structure, and impairing power, may prove still the precursor of ulceration. Or, to state it more simply, the inflammation may still prove asthenic; its results on primary texture destructive, its products incapable of plastic repair. The system may be gradually worn out by the suppuration and its hectic. Or acute inflammation may seize on the part; as is not unlikely to happen, on establishment of the aperture for discharge. Irritative fever is lighted up, in consequence; and this may more rapidly exhaust the patient.

The foregoing points of practice, as to the surgically inaccessible sites of caries, are obviously illustrated by reference to lumbar abscess, originating in caries of the vertebræ; by most of the examples of morbus coxarius; and by carious ulceration of the articulating surfaces composing the knee-joint.[1]

Death of Bone or Necrosis.

This may be the immediate result of external injury, the bone at once parting with its vitality; as in extreme burns, in which all the component textures of the limb are instantly converted into an inanimate eschar. Much more frequently, it is the indirect result of injury; the bone perishing by an overpowering inflammation. When unaccompanied by any other form of disease, it is said to be Simple; Compound, on the other hand, if combined with caries, or attendant on fracture, as not unfrequently happens. When consequent on wound or other external injury, it is called Traumatic; Idiopathic, when originating without any appreciable exciting cause. Often in the young, a bone is acutely inflamed without any apparent reason, rapidly becomes the seat of suppuration, and dies to a greater or less extent.

Also, necrosis may be either *Chronic* or *Acute*. Or, rather, the ostitis which leads to local death may be either chronic or acute. For the major part of necrosis—that is, separation of the dead portion of bone, and formation of its substitute—is invariably chronic; occupying long time in completion, and accompanied by but a very minor grade of the inflammatory process.

The extent of necrosis is very various. A mere leaf or scale of bone may perish on the external surface; and this is termed *Exfoliation*. A larger and considerable portion of the laminated texture may die; or this may retain its vitality, while the cancellated interior perishes. The dead portions, or *Sequestra*, are called External and Internal accordingly; and like terms are applied to the necrosis. Or the whole thickness of the bone dies, in one continuous mass; and the disease is then said to be General. This general necrosis varies much in its extent. Sometimes but a slight portion of a long bone so perishes and is thrown off; sometimes several inches; sometimes nearly the whole. But it is seldom that the entire bone suffers. Usually the articulating extremities remain; the line of separation occurring there; a fact which has been long recognized by the surgeon, and that gladly, as compassing two good ends. First, the process of reproduction or repair is thereby facilitated; second, the joints are saved from purulent irruption, and from the inflammatory destruction which would necessarily follow.

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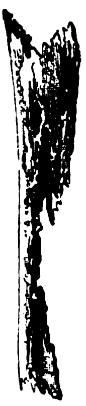
[1] By Mr. Goodsir, the term caries is limited to a peculiar state of bone. "In true caries, for a certain depth below the surface of the affected part, the corpuscles and canaliculi have more or less completely disappeared, so that the subjacent unaltered osseous texture is covered in by a layer of apparently homogeneous solid bone resembling marble. It is analogous, in some respects, to the enamel of the teeth; 1, in not being covered by soft parts; 2, in being a portion of the exterior surface of the body; 3, in containing no corpuscles or canaliculi; 4, in being incapable of absorption, and requiring therefore to exfoliate, or to be removed artificially."—*Monthly Journal*, February, 1850, p. 102.

Fig. 129.



Sequestrum; seen laterally; the external portion smooth, the internal rough and irregular.

While the cancellous tissue of bone is prone to caries, necrosis is of more frequent occurrence in the dense and compact portions of the skeleton. And this in part accounts for the salutary fact just s[illegible]ely, that necrosis generally stops at the articulatin[illegible]he bones.

The articulating ends of the long bones are not exempt, however, either from involvement in general necrosis of the shaft, or from the disease occurring in a more limited form within themselves. Examples of the latter affection are not uncommon in the head of the tibia, in young adults; and often attributable to external injury. Death of even a small part of the cancellous tissue there is a formidable disease; by reason of the great risk to which the knee-joint is exposed, of secondary and destructive involvement.

The bones most liable to suffer are those most exposed to atmospheric influence and mechanical violence. The tibia enjoys an unenviable pre-eminence in this respect; next may be ranged the femur, especially at its lower part; then the humerus, cranium, lower jaw, clavicle, ulna, &c. The disease, more especially in its acute form, prevails more frequently in the young than in the old. And its causes may be briefly stated to be the same as those of the first stage—ostitis. Of late years, an especial cause has been found to affect the jaws; namely, phosphorous acid vapor, generated in the manufacture of lucifer matches. Persons employed in this trade have suffered greatly from necrosis of the upper or lower jaw, sometimes of both; great deformity ensuing, and sometimes even death. The noxious vapor, perhaps, acts in two ways; impairing the general health, and fatally stimulating the periosteum.[1] Its main action, however, seems to be local; on the periosteum. And, in proof of this, it is observed that those persons only suffer who are affected with caries of the teeth; and whose periosteum is consequently directly exposed to the noxious vapor. The disease usually begins with moderate periostitis, which thickens the membrane, and incrusts the jaw with new bony formations. Then acute inflammation supervenes; the new bone exfoliates, the soft parts slough and ulcerate, and necrosis more or less extensively destroys the jaws.

The *Process* of necrosis may be conveniently divided into stages.—1. *The bone, or portion of bone, inflames.* Those cases in which the bone is directly killed by external violence, we have already stated, constitute a minority. In considering the process, therefore, it is right that we describe it as it most frequently occurs; and accordingly we begin with inflammation. This may be the result of external injury; as wound, bruise, or fracture; or it may be of apparently spontaneous origin. It may terminate in local death, either in consequence of its own intensity, or on account of this being associated with diminished power in the part affected. The associated cause is more frequent than the single, in cases of traumatic origin; the injury not only kindling ostitis, but at the same time diminishing the vital power by which it is to be opposed.

In wounds implicating bone, the periosteum is often removed; and this obviously impairs power in the part so stripped, which accordingly, on the supervention of ostitis, is predisposed to die. But it by no means follows that because a portion of bone has been denuded of its periosteum, even rudely, it must inevitably become necrosed. Acute ostitis occurring, necrosis is imminent, but not inevitable; the part may yet retain a sufficiency of power for a successful struggle, and live. But if the periosteum, and the membrane lining the interior—sometimes termed endosteum—both perish, or be removed at corresponding points, death of the portion of bone so isolated, and cut off from its vascular supplies, is then indeed certain. Little inflammation in such circumstances suffices to complete that result.[1]

When exposed bone retains its vitality, it is of a brown hue, sounds dull on being struck, emits blood when rudely handled, and is covered by a self-secreted fluid. On the contrary, if it be dead or dying, its color is white; it is resonant when struck; it is dry, unless when moistened by purulent secretion from the surrounding parts; and it does not bleed when touched, however rudely. Such signs are useful as not only auxiliary to diagnosis, but bearing strongly on the mode of dressing. However, it must also be well understood that a bone, stripped of periosteum, may at first show all the usual indications of retained vitality, and yet whiten and die; and also that an exposed portion of bone may become white, sonorous, and apparently non-vascular, shortly after infliction of the injury, and yet recover with the thinnest possible exfoliation. In the latter class of cases, the process of renewed and increased vascularization, in a part previously exsanguine, may often be seen beautifully exemplified.

2. *The bone dies.* The changes just detailed, indicating death of bone, occur sometimes very rapidly, and are completed in a few hours. In other cases, the event may be protracted for several days; as if life were gradually and reluctantly relinquished. If previously, during the condition of simple ostitis, the periosteum were adherent, it is now completely detached; and purulent secretion is interposed between it and the bone.

According to the rapidity with which bone dies, the appearance of the dead part varies. If death be rapid, the bone has had no time to change its structure, under inflammation resident in itself; and it consequently, as a sequestrum, retains the character of normal bone. Its external surface is smooth and compact; and it looks like a portion mechanically removed from a sound skeleton. But if ostitis have existed in the part, for some time previous to its death, then its appearance will vary, when dead, according to the duration and intensity of that affection; rough and porous, swollen, ulcerated, dense, &c. The first condition is the more frequent.

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[1] A marked sympathy of function has been observed between the periosteum and endosteum. When the former has been destroyed, the corresponding portion of the latter becomes peculiarly active; often causing an obliteration of the medullary canal at that point by a deposit of recent bone. After injury to the endosteum, similar sympathy is evinced by the periosteum. In fact, destruction of either membrane involves an increased duty and activity of production in that remaining.

3. *The dead portion is separated from the living.* The death, or second stage, is often rapidly completed; and is never long protracted. This, the third, is invariably tedious and slow. The mode of detachment is similar to that of sloughs in soft texture (p. 236); but very different as to the time employed. A slough separates in a few days; while weeks or months may elapse, an [illegible] ent of the sequestrum may still be incomplete.

The extent of the necrosed portion is indicated by its white, sonorous, insensible, and non-vascular character; and these it retains throughout the whole process; seeming as if it were a macerated portion of skeleton. The only change likely to occur is a darkening of its hue, by exposure to atmospheric influence, or to chemical action from contact with purulent secretion. But around this unchanging dead portion, and more especially in the parts immediately continuous with it, there is great activity. The color is red or dark brown; evidently from increased and increasing vascularity. The slightest touch is painful, and followed by blood, of a florid arterial hue; a clear fibrinous secretion is slowly exuding; and the gentlest touch of probe or finger plainly indicates a softening of that part, by removal of a large proportion of its earthy matter. It is also considerably swollen. In short, while the dead part is undergoing no change, unless perhaps a variation of hue, the living parts all around are soft, swollen, and increased in vascularity; busy in carrying on an inflammatory process of a truly sthenic kind. This quickly terminates in suppuration and ulceration. And so a sulcus is begun; which, by gradually deepening, ultimately—but not, it may be, till after a long time—detaches the dead from the living; resolving the former into the condition of a loose sequestrum.

Fig. 130.

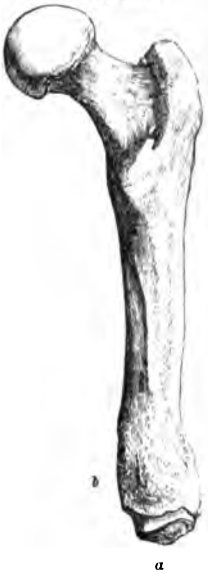

Fig. 131.

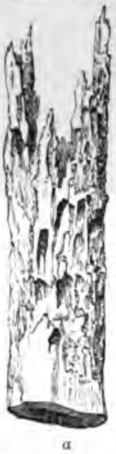

Fig. 130. Necrosis of the femur, after amputation. At *a*, the sequestrum in process of separation. At *b*, the parent bone enlarged, and undergoing inflammatory change, necessary for detachment and repair.

Fig. 131. The sequestrum detached: at its lower part, *a*, including the whole thickness of the bone. Gradually shelving upwards, as such sequestra usually do.

As in the similar process in soft parts, ulceration does not proceed alone. Reparation follows quickly on its heel. And no sooner has the primitive sulcus been formed by the work of destruction, than osseous granules begin to spread, by the work of repair, from the margins which the ulceration has only just left. The state of separation commenced immediately on the completion of that of death; and the former was not well begun, ere the work of reproduction had laid its foundation. Therefore it may be said, so wise and provident is Nature, that the necrosed part is scarcely yet dead, ere the formation of its substitute has been duly set in progress.

Separation, it has been stated, is invariably slow; and it is well that it is so. For the formation of new bone, to supply the place of the old which has perished and must be thrown away, is also a process inevitably tedious, even although early begun. The two—separation of the old, and reproduction of the new—advance *pari passu;* and it is surely a most beneficial and wise arrangement, which has decreed that the one shall not be completed leaving the other much imperfect; that the portion of old bone shall not be loosened, and cast away as a useless thing, until an efficient substitute has been prepared to occupy its place and function.

During the process of separation, by ulceration, there is necessarily a constant, and often a profuse secretion of pus. This is discharged externally, through apertures in the soft parts already existing; or it burrows and accumulates at new points, where free and dependent incision soon comes to be demanded. The discharge is usually thick, and yellow; laudable in appearance; charged with more or less of the ulcerated debris; and invariably possessed of an oppressive and peculiar fetor—a sickening heavy odor, which, when once perceived, will ever after be readily recognized—a sure sign of necrosis. When analyzed, the discharge is found to contain a very unusually large proportion of earthy matter; doubtless the molecules of disintegrated bone, which are sacrificed by the living margin to rid itself of the dead sequestrum (p. 129).[1]

Sometimes a pulsating movement is observable in the part, during the progress of separation; owing, probably, to the increased vascular function so busy in the process.

4. *Separation of the dead portion is completed.* Ulceration has encompassed it on all sides and beneath. It is now loose; unless where hemmed in by exuberant formation of new osseous matter above and around, as is not unfrequently the case—a redundancy of reparative effort by no means to be complained of, being obviously by much the safer side on which Nature may err. The sequestrum is now to all intents and purposes a foreign substance; detached from the living; of no further use, and no longer recognized as a part of the living economy; on the contrary, a noxious body whose presence is resented by continual suppuration and excitement in the living parts, and which cannot be too soon extruded from the system.

Sometimes the death and separation are not continuous, in mass; but in small successive portions, many or most of which may be so minute as to escape observation. A superficial portion of bone dies; and instead of separating in the usual way, gradually disappears. It seems to have been absorbed. But, in truth, it has come away in small thin flakes, or in still more minute particles. And the process of such removal has been termed by Miescher *Insensible Exfoliation.*

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[1] In pus from parts around diseased bone, phosphate of lime was found in amount nearly 2½ per cent.; while in pus elsewhere obtained, only traces of phosphate of lime were discovered.—*Transby Cooper, Med. Gazette, May,* 1845.

5. *The dead portion is extruded.* As in the threatened lodgment of any other foreign substance, suppuration is the main agent here. By pus a loose sequestrum is, as it were, floated to the surface, and there exposed. And if surgery be either slothful, or altogether in abeyance, Nature may even complete the task of final discharge; though slowly and painfully, and with much e[illegible] to the general frame. But another agent is also at work. [illegible]cients it was supposed, that the dead portion was simply pushed on by granulation from beneath: ere yet it was detached from its continuity with the living texture. Such we have seen is not the case. It is first separated by a very opposite process; not formation of new matter, but disintegration of the old. But to this disintegration of the old, as a means of separation, formation of new as a means of repair almost immediately succeeds. This work of repair is not limited to the margins of the sulcus, but follows the ulceration throughout its whole track. So that, when the dead part is completely detached and loose, it is virtually borne on a bed of granulation; which, continuing to enlarge upwards, in the reproductive effort, obviously assists in carrying outwards the sequestrum and favoring its approach to the surface. At the same time, be it ever remembered, this and every other effort towards expulsion may be fully counteracted, by retention of the dead and detached part; in consequence of a tight embrace of the living substitute, which has formed over and partially encased it.

And in another way spontaneous extrusion may be prevented; the sequestrum seeming to be attached, while truly separate. These same granulations, subsequently changed into fibro-areolar tissue, may interlace themselves through the irregular, and often cribriform margins of the dead part; as creeping plants twine through trellis-work.

By some this irregular and cribriform appearance, so commonly observed, has been accounted for by supposing that the corresponding granulations have by their absorptive powers consumed the bone, and made the perforations and spaces. But it is more rational to conclude that these are the result of bone having died irregularly, not with a bluff clear line; that they have been formed by ulcerative disintegration of the living bone at these points, during the general process of separation; and that, in the third place, as to time—not in the first—the granulations have shot up to occupy, and fit themselves to, the spaces and perforations already made and vacant.

It is supposed that occasionally the process of separation is somehow arrested, and may remain for years incomplete. No doubt sequestra have been found undetached, many years after injury done to the part. But proof is wanting to show that necrosis was coeval with the injury. More probably, in such cases, the formation of the sequestrum resulted from a later ostitis; and its separation was truly progressing in the ordinary way.

The sequestrum is always less than the space left on separation, as can readily be understood; allowance being made for amplification of the latter, by the destructive process in the living bone whereby separation is effected.

6. *Reparation is completed.*—This, we have already seen, begins at the same time as the process of separation; and is originated by the old bone, at the living margin of the ulcerative sulcus. From this point it advances, consentaneously with the process of separation; in two parts, a deep and superficial. The former following close in the track of the ulceration, consists of osseous production from the living bone beneath the loosening sequestrum. The other, begun by bone, but apparently carried on by periosteum, invests the dead part on its exterior; gradually shelving over and incrusting it, as bark does a tree; and hence often termed the *Cortical* portion of the *Substitute*, or new formation.

Wherever the periosteum is entire, there the formation of this cortical bone proceeds, continuously with that which has come from the parent shaft. But, in several places it is probable that periosteum is deficient. So soon as the part died, its periosteum became detached from it; and pus was interposed. This pus must, sooner or later, find its way to the surface. And, for this purpose, solution of continuity is

Fig. 132.

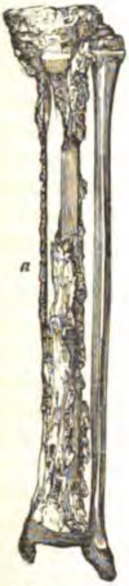


Fig. 133.

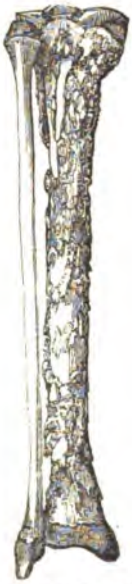


Fig. 134.

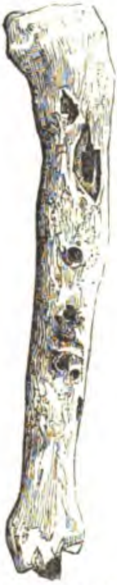
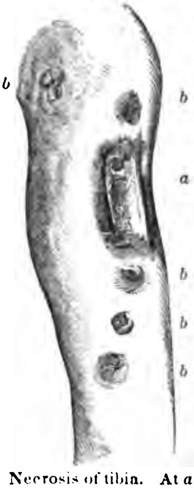


Fig. 132. Acute necrosis of the tibia. The bone extensively perished at *a*; the cortical formation has begun to form. Fibula, as usual, unaffected. Fig. 133. Necrosis of tibia; more advanced. Cortical formation investing the greater part of the old bone. Fig. 134. Necrosis of tibia; in the chronic stage. Cortical, or substitute bone, complete, and consolidated. At several points cloacæ seen, leading down to the sequestra.

made in the investing membrane; either by the knife or by ulceration, more frequently by the latter. Such apertures remain open, not unfrequently widen, and through them pus continues to be discharged. The cortical formation, begun by bone, and apparently maintained—nay, chiefly effected—by periosteum, having reached such an aperture, has its continuity interrupted. Where the membrane is deficient, so is the osseous shell. It passes round the margins; and an aperture is formed in the newly constructed case of bone, corresponding to the opening in the periosteum. In fracture, without suppuration, ossification is begun by bone, is continued by periosteum, and where that is deficient is sustained by the surrounding parts, which assume periosteal character and function; and [illegible]tly the incasement of bone, under such circumstances, is cont[illegible]ut here there is no substitute for deficient periosteum; the surrounding soft parts have suppurated, and are themselves reduced to the condition of an aperture or canal for discharge of matter.

This, however, is not a disadvantage. On the contrary, were deficiencies of periosteum invariably supplied by adventitious structure of similar capabilities, the cortical formation would also invariably be continuous; purulent matter would be denied an outlet; and all the pains and dangers of acutely accumulating and deeply seated pus, would inevitably ensue. As it is, deficiency of periosteum is not supplied; and the cortical formation is at that point proportionally defective. A permanent aperture, termed *Cloaca*, results (Fig. 134); communicating internally with the cavity which contains the sequestrum, opening into the suppurated aperture and canal of the soft parts exteriorly, and of the greatest use in securing efficient discharge of purulent or other fluids.

Fig. 135.



Necrosis of tibia. At *a*, the dead bone exposed. At *b*, *b*, the papillæ represented, communicating through cloacæ with the sequestrum.

The external orifice of this discharging canal is usually callous, and of an elevated or pouting character. It is termed a *Papilla;* and in every case where necrosis is at all extensive, there are not one, but several such purulent canals; through the cloacæ, in connection with which, a probe may be made to impinge on the sequestrum.

Through these apertures, the condition of the dead portion may be from time to time ascertained; and so soon as it has become loose, it is through these apertures, enlarged if need be, that it is removed. When it has been discharged, the two portions of the new osseous formation coalesce; and so complete the construction of the dead bone's substitute. Hitherto the sequestrum, as a foreign substance, was interposed between; now the cortical frame, descending, comes ultimately to mingle the soft osseous granules of its internal aspect with those which are rising from the subjacent stratum of original bone. And so, somewhat as in chasm of the soft parts, the cavity, previously occupied by the sequestrum, is filled up; partly by continued formation of new matter, partly by mutual approach of the parts already formed. Suppuration ceases gradually; the cloacæ, no longer useful, may slowly fill up—or at least diminish—by new formation from the osseous margins; the whole part becomes firmly consolidated; and the inflammatory process altogether subsides. Should the cloacæ remain unclosed, the soft parts will notwithstanding heal kindly over them; provided there be no dead bone remaining, to keep up inflammation and discharge.

Before removal of the dead part, there was much bulky swelling of the limb; partly from the infiltrated condition of the soft parts, partly from the elevated position of the cortical bone. But now this latter seeks a lower level. Besides, absorption so acts as to condense and strengthen the new texture; rendering it more efficient as part of a column of support. And, at the same time, the inflammatory process having in all its grades and everywhere abated, absorption is not idle in the superimposed soft texture. In consequence, the unseemly swelling gradually disappears; and, ultimately, the part has both its function and its symmetry more or less completely restored.

An analogy plainly exists between reproduction of bone, and reparation of lost substance in the soft parts. The granulations which fill up the latter chasm, and, restoring all to one level, permit the formation of new integument, are analogous to the new osseous production from the parent bone. The cuticular investment, gradually extending from the circumference, to effect cicatrization, has for its analogue the cortical formation beneath the periosteum; which, covering in the deep substitute, may be said to effect its cicatrix.

Hitherto, we have been speaking of the restorative process as occurring in a case of partial necrosis; an external portion only having perished; living bone on one side, and periosteum on the other. Events are very similar in the other forms of the disease. When the necrosis is Internal, a part of the cancellous texture only having died, reparation follows rapidly on extrusion of the sequestrum. This takes place through an aperture, formed by ulceration, in the laminated portion; which opening, like the corresponding interruption of continuity in cortical formation, is termed a cloaca. And when through this, whether by nature or by art, extrusion has been effected, reproduction is accomplished entirely by the surrounding living bone, which constitutes the parietes of the cavity in which the sequestrum lodged. At first, the new structure is of preternatural density; but by the continued work of absorption, continuity of normal texture is ultimately re-established.

When the internal sequestrum is small, the original inflammatory affection having been but limited, and the present suppuration being but slow and slight, ulcerative perforation of the bone for discharge of both pus and sequestrum may be a very tedious process. Meanwhile, by continued presence of the foreign body, within, ostitis of a minor grade is permanently maintained in the vicinity, and perhaps to a wide extent. In consequence, the bone may become much enlarged, as well as condensed in its structure; and often is roughly nodulated on the exterior. A somewhat similar change in the shaft of a long bone also follows the formation and lodgment of a large internal sequestrum; in connection with which a cloaca may have been early formed, but too minute to admit of spontaneous extrusion.

When a portion of bone including its whole thickness has perished, the process of separation advances in the usual way; as also the commencement of reparation, by osseous production from the living margins of the sulcus. The osseous production, begun by the bone, is continued by the periosteum; shelving over the whole exterior of the dead part. The sequestrum, when loose, is dislodged from its parallel relation to the living shaft; and this may perhaps be the work of surrounding osseous granulations. It then gradually seeks the surface. And thus both room and opportunity are afforded for the parent bone, on each mutilated aspect, to send forth its reproductive formation. After extrusion of the sequestrum, the new cortical portion falls inwards, as usual; and, coalescing with what is being formed by the old bone, a solid and efficient substitute is ultimately obtained.

Restoration of the bone's continuity is due to both bone and periosteum. The former tissue takes the initiative in the process; and the two formations, from periosteum and bone, advance together, in harmonious co-operation.

Complete reproduction, however, is not to be expected in all cases. If a small portion only of the entire thickness perish—say half an inch, or an inch—doubtless it will be ultimately though slowly reproduced. The parts are equal to the task required of them. The bone, more especially, is quite able to overtake its part of the duty; the osseous formation, from either end, uniting to form a dense and compact reunion of the central portions of the shaft. In all cases, the periosteum, when left entire, is capable of executing its share; namely, formation of the cortical portion. But that is not enough. The cortical portion, if left to itself, after extrusion of the sequestrum, unsupported by an interior production from the bone, shrivels and bends; is altogether insufficient as a column of support; and ultimately comes to be in a great measure removed by absorption. Now, reproduction from the mutilated osseous surfaces can only extend a certain length. In the higher classes of animals, reproduction of tissue is not indefinite, but has its limits. The two portions of bone will shoot out new matter, readily, so as to effect union by restoration to the extent of an inch or two. But in seeking to traverse a greater space, the reparative effort is likely to flag and fail. The osseous nodules do not coalesce; but taper finely off, ending in a point coherent with the condensed soft tissues around. And therefore, practically, it must be remembered, that when a sequestrum has come away, including almost the entire shaft of a long bone, reproduction can scarcely be expected to prove complete; and probably the limb will, ever after, be more or less inefficient as an organ of support and motion. It is astonishing, however, how successful the restorative effort sometimes proves, even in circumstances of but little hope. In not a few instances, long bones have been almost wholly reproduced. And, therefore, in necrosis of the entire thickness of the shaft, even of great extent, a chance of cure in the ordinary way ought invariably to be afforded. The short bones, however, if wholly necrosed, are never reproduced. And reproduction is also rare in the flat bones; especially the cranium.

Also, let it be borne in mind, that for suitable reproduction, under any circumstances, it is essential that true inflammation shall subside; otherwise, fibrinous deposit will prove but sparingly plastic, its major part degenerating into purulent matter. In practice, our principal care is directed to ward off inflammatory reaccession; knowing well that should this occur, repair will be interrupted; the cure will be at least delayed, and perhaps rendered wholly abortive.

Such is necrosis. It may be partial and External. Then the sequestrum has its peculiar characters. As formerly stated, the doomed portion usually parts rapidly with vitality, at an early period of the disorder; ere it has time to undergo change. And, accordingly, it presents, on its removal, the usual appearances of the external, dense, laminated texture of bone; as if it were part of a macerated skeleton. But it is rough and irregular, at its lower and lateral aspects; where, by the ulcerative process, it has been slowly and unequally separated from the living tissue (Fig. 131).

Or necrosis may be partial and Internal (Fig. 122). Then the sequestrum is very distinctive of its original site; being not only loose, as ordinary cancellous texture, but also rough and scabrous at every point; showing no surface of a smooth and laminated character—unless it be the comparatively smooth internal surface of the medullary canal.

Or the entire thickness is included; the sequestrum consisting of a portion of the bone which is rough and irregular at either extremity; but in other respects seeming as if artificially removed from the skeleton. And thus, according to its situation and extent, a sequestrum, like its parent ostitis, is termed Internal, External, or General.

Symptoms.—The symptoms of necrosis are, at first, those of acute ostitis. Suppuration having occurred, these are aggravated; no relief following the suppurative crisis, as sometimes happens in the soft tissues; for here the first investment of the pus is invariably dense and unyielding. But relief comes with evacuation of the matter; whether effected by nature or by art. By the former, the process is tedious, and abatement of the symptoms proportionally slow; by the latter, if early and efficiently adopted, relief is both instant and great. All the surrounding soft parts are very much involved, from the beginning. At first infiltrated by a plastic exudation; causing consolidation, as well as thickening and enlargement. Afterwards the seat of suppuration, more or less extensive; sometimes diffuse, more frequently limited by fibrinous condensation.

The matter is discharged, usually, through several apertures; the number generally bearing a proportion to the extent of the disease. The pouting external orifice, as already stated, is termed a papilla. The internal is termed a cloaca; the result either of deficiency of the periosteum, or of perforation of the old bone—according as the necrosis happens to be internal, or not. Through the canal, which ultimately assumes quite a fistulous character, the presence of the dead portion of bone is detected; and its condition as to detachment may be from time to time ascertained, by the use of a probe—or, what is better, by introducing the finger, should space permit. When the sequestrum is internal, it is felt rough, yet dense; when external, it is felt smooth and solid, except at the circumference, where by the sulcus of separation the bone has been rendered rough and irregular.

During the stage of separation, and the concomitant one of reparation, discharge is continued; usually copious; and invariably fetid, as before stated. In consequence of such discharge, the constitutional symptoms which during the ostitis, both simple and suppurative, had shown all the characters of acute inflammatory fever, often intense, may change now into hectic.

But the local inflammatory process has not yet subsided. So long as the foreign body—as the sequest [illegible] is—remains unextruded, the living parts will continue to rese [illegible] ence. True inflammation is sustained in its immediate vicinity, as essential towards the ulcerative suppuration; a minor grade of the process continues to pervade the whole part; the substitute bone is busily advancing; in the soft parts, deposit is still in the ascendant, and absorption is doing but little towards remodelling the limb. Besides, the soft parts become increased in vascularity, sometimes to a very considerable degree; so that when incised—and they cut like a piece of gristle, rather than ordinary soft textures—hemorrhage is invariably profuse; not only because the vessels are both active and numerous, but also in consequence of natural hemostatics being opposed by the dense structural change in which the vessels are embedded.

Should inflammatory reaccession occur, the symptoms will all be renewed with their pristine severity. And if the newly-formed pus be so situated as not to find a ready exit, it is most probable that serious extension of the original necrosis may ensue. Thus it may happen that necrosis, originally limited to but a small part of laminated texture, may ultimately involve, not only the whole thickness, but almost the whole extent of a bone.

When the sequestrum has become wholly detached from the living bone, it does not always seem loose. For it may, at more than one point, be bound down by the tight embrace of the new cortical formation; or, as already mentioned, newly-formed texture—fibrous or cartilaginous—may be interwoven with its cribriform parts. Or new bone may be deposited, in points or patches, so closely on the dead part's surface, as actually to establish again their continuity. Or new bone, like the softer textures, may interlace the cribriform spaces of the sequestrum. Generally, however, so soon as detachment is complete, the sequestrum is more or less movable; as the finger or probe will testify. And if not then artificially removed—as it should be—in due time it makes its appearance at the surface, and projects there; the protruded portion becoming blackened, apparently through atmospheric influence. As a general rule, it may be safely held that a dead portion of bone, which is protruding through an external opening in the soft parts, has been completely loosened from its connection with the living bone; and that if it seem fixed, it can only be on account of secondary retention in one or other of the ways just mentioned—most probably by cortical embrace.

Sometimes the substitute itself perishes, by inflammatory accession; a result not at all improbable, when we consider how recent and comparatively incomplete is its structure, and consequently how low its vital power of resistance or control. And this affords another reason, why such inflammatory reaccession should be anxiously provided against, throughout the whole period of repair. Should the superimposed soft parts happen to become the seat of hospital-sore, the substitute cannot fail to be more or less exposed and involved; and may consequently die and come away, in whole or in part.

When the sequestrum has not only become loose, but also been fairly removed, the inflammatory process gradually subsides in all its parts. The cortical portion of the substitute contracts, condenses, and sinks, to meet the rising new structure; which has been elaborated by the parent bone, and which has been a means of effecting displacement of the dead part. The two portions having coalesced, deposit and absorption advance in harmony within the mass; fashioning it into a goodly imitation of the part which has been cast off; and restoring both symmetry and function to that portion of the skeleton. At the same time—the inflammatory process gradually fading, as it recedes from the centre of operations—deposit ceases to be excessive in the soft parts; absorption becomes actively engaged in removing the excess which has already occurred; and both the induration and enlargement of the whole limb slowly subside. Ultimately, the normal girth is approached, but is seldom, if ever, actually attained. Pain and stiffness gradually diminish; and function, too, is restored.

The time occupied by the various changes is extremely various. In acute external necrosis, of a very limited extent, many days may not elapse between the first onset of the inflammation and final extrusion of the sequestrum. In more extensive examples, by weeks we will prove more correct reckoners of the time. When the whole thickness of a bone has perished, to some considerable extent, many months may be, and usually are, consumed, ere the bone has been got away; and at least an equal term may be required ere, subsequently to that event, the limb resumes even an approach to its pristine form and function. In the young and otherwise healthy, progress will be more rapid than in the aged and infirm; and much will also depend upon treatment. If inflammatory reaccessions have been either directly induced, or not sufficiently provided against, the term of cure may be protracted almost indefinitely. In spongy bones, too, the process is ordinarily more rapid than in dense; the former being more vascular, and better capable of energetic effort. Also the bones of the superior extremity have an advantage, in this respect, over those of the lower.

Treatment.—Again, prevention is to be considered paramount. Treat the preliminary ostitis with energy, yet warily; in order that it may be arrested in its progress, ere any destructive result has yet begun. When suppuration has taken place, and the doomed portion or portions of bone are dead or dying, our object is a minor one; to mitigate symptoms, prevent extension of evil already incurred, and favor the advancement of repair. The first, and not the least important indication to be fulfilled, is early and efficient evacuation of the purulent formation which bathes the inflamed bone, and has detached it from its periosteum.

Some considerable time must be unprofitably consumed, ere pus can work out its own discharge, through the periosteum and other unfavorably investing tissues; meanwhile the patient's sufferings will have been great, and aggravation of the original evil not inconsiderable. Time, texture, and torture may be all saved, by an early, free, and direct incision; which, accordingly, should invariably be practised, so soon as the indications of suppuration are sufficiently manifest.

Detachment of the sequestrum we commit entirely to Nature; contenting ourselves with overlooking her operation; and taking especial care that she shall not be interrupted. With this latter object in view, the part is kept quiet, used as little as possible, and not put in the way of external violence. By some, exercise of the affected part is enjoined, with a view to expedite separation [illegible]d portion, when that seems to be unreasonably slow. But to my mind the practice seems fraught with danger, as regards aggravation and extension of the disease by inducing inflammatory reaccession. Should this at any time threaten, leeches, fomentation, absolute repose, and general antiphlogistics if need be, are at once employed with a view to its speedy arrest. On this account also, during the chronic stage, when perhaps purulent secretion is great, and hectic is either threatened or fully developed, and when consequently we are anxious to support the system in its difficulties—that support must be prudently conducted, and made to vary from time to time, as circumstances may demand.

When the sequestrum has become wholly detached from the living bone, by completion of the ulcerative sulcus in the margin of the latter, Nature's exclusive operation is over; and it is then our cue to interfere. Nature's power of detachment is adequate and admirable, but her power of extrusion is weak and imperfect; and the surgeon who deliberately imposes on her the latter effort, is both negligent and unskilful. She may, and often does, accomplish the task; but only after much suffering by the patient, and exhaustion of his frame; and not until much structural change, perhaps irremediable, has occurred in the part—all unnecessary, and which, by judicious assistance of the surgeon, timeously afforded, should have been altogether prevented.

But perhaps a more common error in practical surgery is, interference with the sequestrum before it has become loose. To lay hold of it then, and use violence, after exposure by incision, is certainly to induce a combination of evils. The revulsive effort fails; and, consequently, the patient has been put to a grave amount of pain unnecessarily and fruitlessly. By the violence, inflammatory reaccession is certainly induced; in and around the part originally implicated. In other words, a fresh ostitis, probably both acute and extensive, is induced; and aggravation of the necrosis is most likely to follow. Also, the loss of blood which attends on such an attempt, whether successful or not, is invariably considerable; coming from a wound of soft parts, which are not only unusually vascular, but, besides, unfavorable to natural hemostatics, as formerly explained (p. 309). And the patient's state of system is generally such, in the advanced stage of necrosis, as to be altogether intolerant of a repetition of such hemorrhages. Therefore, on this last ground alone, it is plain that the operation for removal of a sequestrum should never be undertaken, unless the surgeon be tolerably certain that his effort will then prove successful.

During the whole stage of separation between the dead and living bone, Nature is to be left entirely to herself; the surgeon being only an interested on-looker; prepared to ward off inflammatory reaccession by suitable antiphlogistics, should that threaten to occur; and careful to limit motion, in order to avert fracture or bending of the changing member. From time to time, he may, by his finger or probe, ascertain the rate and extent of progress; yet using all most gently. Every rudeness of examination must be carefully eschewed; as being prone not only to interrupt formation of the substitute, but also to extend anew the limits of the necrosis.

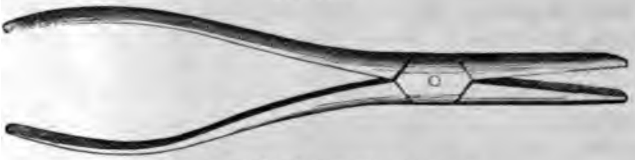
In probing, the simultaneous use of two instruments is sometimes advantageous. One probe resting on the end of the sequestrum, a second is introduced through another cloaca; and by pressing with each alternately, looseness of the sequestrum may be made plain, in circumstances otherwise extremely doubtful.

When the shaft of a long bone is separating, of its entire thickness, and to a considerable extent, especial care is necessary to keep it supported and immovable: for several reasons. By movement, or by spasm, it may bend or break; a spiculum may perforate a large bloodvessel, or irritate a joint; or the articular extremities may be approximated, entailing great and permanent shortening and deformity.

So soon as the sequestrum has become loose, by Nature's effort—not later, and not before—the surgeon is called upon to take the necessary steps for its removal. An incision is made through the superimposed soft parts; neither too free, causing unnecessary loss of blood; nor too limited, obstructing the subsequent procedure by want of space. Through the cloaca or cloacæ, the extent and form of the dead portion or portions are then ascertained; and if the natural opening afford space enough, through this forceps are introduced, and the sequestrum seized and extracted. It usually happens, however, that the natural openings are not sufficient; the sequestrum proving large, and having become on all sides invested by stout cortical formation. It may be necessary, therefore, to convert two cloacæ into one; by the saw or cutting pliers (Fig. 125). Or one cloaca, whether in old or new bone, may be enlarged to the required extent, by the cutting pliers; or more suitably, in most cases, by the trephine. In all cases, however, let as little of the new bone be sacrificed as possible. For, once removed, it will not be reproduced; and the limb, in consequence, may be permanently and unsafely weakened, as well as deformed.

The sequestrum having been duly exposed, the laying hold of it comes to be of some consequence. Forceps are the best adapted instrument; but, in general, they are used much too small and feeble. The common dressing forceps, as found in the ordinary pocket case, are quite unsuitable; except for very small sequestra, wholly unconfined by cortical formation. Strong blunt pliers, made for the purpose, should be employed; like bell-hanger's pliers, only longer in both blade and handle, with the former well serrated to prove surely prehensile, and powerful in every part. By means of these the dead portion is firmly grasped; and is moved to and fro, so as to insure its freedom from the surrounding substitute. Then, by a steady pull, it is brought to the surface; leverage power being used, if need be, to break up any farther obstacle which may obstruct its fi[illegible]al. Such determined procedure saves pain, time, blood, and trouble. For the smaller and shorter instrument is prone to slip; only after repeated efforts is a truly secure hold obtained by it; and thus often much wriggling and real force are required, to overcome unexpected obstacles by unequal means. When the sequestrum is long, and the main aperture leads to its middle rather than to either extremity, extraction is often much facilitated by cutting through its centre with the bone pliers, and then extracting each portion separately.

Fig. 136.



Forceps suitable f[illegible]equestra.

Thus, then, the errors most likely to occur, in the manual treatment of necrosis, are three: too early an interference, ere the natural process of separation has been accomplished; attempted removal of the dead portion, when loose, by inadequate means; and the leaving of it undisturbed, when loose, throwing on Nature the labor of extrusion as well as of separation. That the last is an undoubted error is very plain, when we consider that the sequestrum, when loose, is to all intents and purposes a foreign body, and as such will be regarded by the living parts; creating much local disturbance, as well as serious inroad on the constitutional powers; both unnecessary.

By some it has been urged, in defence, or at least in palliation of the indolent system of treatment, that there is a possibility of the dead portion disappearing; in one of two ways, either by absorption, or by solution in the purulent fluid in which it is soaked. That such hope is altogether futile, from either of these events, has been abundantly proved to demonstration. A portion of bone, detached from the living, is plainly not amenable to absorption; unless, by solution, it be presented for absorption in a fluid form. And direct experiments, more especially those of Mr. Gulliver,[1] have clearly shown, that dead portions of bone are wholly insoluble, in the purulent or other fluids, to which in a living part they may be exposed. A dying portion of bone may be partially absorbed, or disintegrated by ulceration; but dead bone is liable to neither absorption nor disintegration, nor to any other vital process. Because a large cavity is found in the interior of a bone, either altogether empty, or containing but a few minute sequestra, we are not thence to infer that the cancellous texture, originally occupying this space, has first died and then been absorbed. It has parted with its vitality, doubtless, not however in a continuous mass, but in molecules; not by necrosis, but by ulceration. And though the dead portions have been removed, they have not been taken back into the system, but pushed forth through the external opening.

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[1] Medico-Chirurgical Transactions, vol. xxi, London, 1838.

At one time it was proposed to apply nitrous or other acids to the sequestrum, with a view to its becoming pliable through loss of its earthy matter, and so capable of being gently pulled away, at the cost of but little pain or blood. The impossibility of confining the acid's action to the part to be destroyed, is a sufficient, because insuperable, objection to the practice.

When the sequestrum has been removed by operation, the wound is stuffed moderately with dry lint; partly to arrest the bleeding, which otherwise might prove profuse; partly to insure the wound's ultimate closure, by a gradual filling up from the bottom. The antiphlogistic regimen is rigidly maintained for some days; as a certain amount of inflammation is an inevitable result of the interference, however gently and skilfully conducted; and it being evidently of much importance to keep such affection within moderate limits. Otherwise, the act of removing one dead portion of bone might become the means of inducing the formation of a second sequestrum, perhaps more extensive. The limb is kept quiet, free from motion and the support of weight; for, as yet, the substitute is hollow, imperfect, consequently weak, and prone on the application of either motion or weight to give way by fracture or bending. Not till some considerable time has elapsed—varying in different cases, according to the circumstances of each—does consolidation of the substitute occur; sufficient to restore not only the appearance, but the function of the bone affected. And, not until then, should the patient be permitted to employ the limb with any degree of freedom. And, indeed, in many cases, in which temporary weakness of the new formation is peculiarly manifest, it is well not to leave immunity from function at the discretion of the patient; but to insure this, and at the same time afford an adventitious support from without, by incasing the affected portion of the limb in splints and bandaging. As already stated, similar care is not unfrequently demanded, during the latter part of the stage of separation; for then, also, the bone is very weak, and prone on exertion either to bend or break. At neither period, however, let the limb be kept constantly rigid and unmoved. From time to time, let the articulations be suppled by gentle and passive motion; otherwise, stiffness, or even actual change of structure by disease, may be induced.

Superficial exfoliation may sometimes be hastened. But this is only an exception to the general rule, of non-interference previous to the completion of detachment. When a thin shell of bone, for example, is coming slowly away from the calvarium, it may sometimes be expedited by applying an escharotic, as the red oxide of mercury, or the chloride of zinc; taking care that the application is limited to the dead portion, and its very immediate vicinity. By combining a more continuous and direct death of the living margin with its molecular disintegration, the loosening of the sequestrum will plainly be facilitated.

Again, after detachment has been completed, a superficial exfoliation of the skull may seem fixed. It cannot be by cortical formation; for, in the cranium, this is seldom if ever produced. It may be the result either of redundant granulation, or of atmospheric pressure. Granulations may have sprung up from the surrounding parts, both hard and soft, but especially from the latter, to such an extent as to partially overlay the dead portion of bone; confining it to its place, even though wholly freed from attachment beneath. In such a case, the redundant soft parts are to be freely pushed aside, by the knife or probe; and the bone, thus liberated, is then removed. Atmospheric pressure, when the cause of undue retention, may be overcome, by fixing a screw in the dead part, and thereby elevating one portion so as to admit the air beneath; then it is loosened in every way, and can be readily lifted from its place.

Amputation is sometimes demanded, though rarely, in necrosis. It is the exception not the rule. It may happen that in acute necrosis of the young, violent inflammatory is followed by severe irritative fever; and both are quickly succeeded by a formidable hectic, which must plainly be relieved, at all hazards, by removal of its cause. Under such circumstances, it may become not only expedient, but imperative to take off the limb; perhaps very shortly after the first accession of the disease while the recently dead bone is yet freshly bathed in pus, and when the process of separation has but just begun. Or, in the more chronic cases, a like summary procedure may be required at a far more distant date; after not only weeks but months had elapsed; when the separation has become far advanced, but is not yet complete; after the system has long borne up nobly, under the exhausting burden of irritation and discharge; but when, nevertheless, it has evidently become unequal to a prolongation of the contest. Such cases, however, it is great happiness to remember constitute but a small minority. The greater number are prosperous in their issue; if duly conducted. The system which has borne up long, is enabled to sustain its task till the end; the dead part is separated and discharged; the substitute condenses and solidifies; the swelling of the soft parts subsides; purulent formation diminishes, and the apertures in both hard and soft parts are closed; the limb is not only saved, but is as useful as before.

On the one hand, we must beware of sacrificing life in the vain endeavor to save a limb; and, on the other, we must be equally careful not to sacrifice a limb, in our anxiety to succor life not yet brought into actual danger; a dilemma in practice, from whose horns we can extricate ourselves, only by a happy combination of knowledge, judgment, and experience. And, in relation to this subject, it is important to remember, that necrosis is not always as extensive as it outwardly seems. Discharge may be copious, fistulæ numerous, soft parts extensively involved, and constitutional disturbance great; and still the sequestrum may be of but limited extent, both in surface and in depth.

Recourse to amputation may also be advisable, in the case of extensive death of a bone throughout its whole thickness, when the expected reproduction has failed. The limb then bends, shrivels, and is worse than useless; its removal becoming a matter of expediency, in the eyes of both patient and practitioner.

In consequence of neglect, a limb may be presented to us much bent, and otherwise deformed; with a large blackened sequestrum, partially protruded from the surface. The appearance may be altogether so unpromising, as to lead a hasty and inexperienced observer at once to advise amputation. But this is never warrantable, under even such circumstances; unless the system be already sunk very low, and plainly unable to bear a prolongation of the strain. Then we amputate to save life; but in the majority of even such examples, we ought to save both life and limb. The sequestrum is removed, with an expenditure of as little blood as possible; the limb is laid in splints; the bending is gradually undone, by bandaging; by suitable diet and medicine, constitutional power is maintained; and thorough restoration of the limb may be ultimately obtained.

It will be observed, that I have refrained from entering on the discussion of a much vexed question in regard to necrosis; namely, the exact mode whereby new bone is constituted. I believe that, in internal necrosis, the formation of new structure, to supply the deficiency of the old, is invariably the work of the parent bone; and that, in both external and general necrosis, the substitute consists of two parts, superficial and deep; the one the product of the old bone, the other usually begun by the old bone, but continued and elaborated by the periosteum. It seems difficult to determine whether this cortical or external portion is entirely formed by the periosteum; or whether the plasma is originally furnished by the surface of the old bone immediately before its death; the periosteum being subsequently intrusted with its nourishment, and with the management, as it were, of its transitional organization into bone. For my own part, I am strongly inclined to coincide with those, who give to periosteum the power of both furnishing the plasma, and conducting its ossification. For, the early death of the original bone, and the suppurated condition of its periosteal connection—a profusion of pus usually separating the surface of the bone from the membrane, and that at an early period—seem tolerably conclusive, as to the improbability of much plastic deposit being found in the suppurated locality. At the same time, I am not prepared to deny that new bone may not be formed from one or all of those sources; from parent bone; from periosteum; from plasma exuded from bone previously to its death, and subsequently cared for by the periosteum; from portions of bone detached from the parent's surface previously to its death, and remaining connected with the periosteum; or from ordinary soft textures, where bone and periosteum happen to be deficient. The last is probably least of all concerned in the process.

But fortunately, the settlement of this matter of theory is comparatively unimportant, while all are agreed on the practical question; namely, that the existence of periosteum, in a more or less perfect state, is at least essential to the cortical formation. Whether the plasma be the production of the membrane or of the bone, the membrane is necessary for its ossification. And hence the necessity of preserving the integrity of that membrane, by every means in our power. It cannot be kept continuously entire; nor is it desirable that it should. Matter has extensively and acutely burrowed beneath it; and, for the discharge of that matter, it must give way, at one or more points. Incision cannot be made too early; both to avert the destructive consequences of an acute abscess, pent up within unyielding textures, and to substitute the minute aperture of the bistoury, for the comparatively wide chasm which would result from spontaneous ulceration. Perhaps even a mass of the membrane, in the state of slough, might come away; as sometimes, nay often, happens to fascia, under similar circumstances. A certain amount of aperture is essential. We find the existence of cloacæ in all respects beneficial; and these, when occurring in substitute bone, depend, as formerly stated, on deficiency of the periosteum. But we desiderate no large chasms in the cortical formation; on the contrary. And therefore it is that we are careful to preserve the periosteum, by early and free incision; so soon as suppuration has formed.

FRAGILITAS OSSIUM.

Bones are most brittle in youth and in old age; but especially in the latter. The oily matter exists in unusual quantity; the osseous texture is lighter and more spongy than in health; and, by interstitial absorption, the external laminated portion has been very much diminished. In truth the bone may, in this unnatural state, be said to consist of cancellous texture; filled with an oily substance, and surrounded externally by a thin brittle lamella.

Such degeneration is apt to follow long confinement, both in those of advanced years, and in those of middle age who have indulged freely and habitually in spirituous liquors; and more especially, when confinement is the result of rheumatic affection. During the progress of confirmed cancerous disease, too, it is not uncommon. Also cachectic states induced by the mercurial and syphilitic poisons, seem manifestly to favor the occurrence of such change in the skeleton; and both scurvy and struma may, sometimes, be not unjustly suspected of a like sinister tendency. The exciting cause of fracture need be but a slight one. A hasty or inadvertent step, turning in bed, rising from the seat or from the knees, a trip on the carpet, or any sudden muscular exertion, may suffice.

Treatment.—When children labor under this affection—as they do comparatively seldom—the existence of cachexy identical with the scrofulous is to be suspected; and by the judicious and persevering employment of treatment suitable for the removal of this, predisposition to fracture from slight causes may after a time be wholly averted. But, in those of advanced age, it is otherwise. The predisposition, and the altered state of the skeleton remain. All that can be done in prophylaxis, is to guard against the occurrence of exciting causes; and, at the same time, we may endeavor to prevent increase of the cachectic state, by a carefully regulated, yet nutritious diet, with exposure to a salubrious atmosphere.

When fracture has occurred, the part is to be arranged carefully, as in ordinary cases of that accident. It may be that reunion will not occur. And it is more than probable that, when it does take place, the process will prove very tedious and the result imperfect. A second or third fracture may occur, during the treatment of the first; the constitution may suffer and sink, and perhaps so rapidly as not even to permit the more than doubtful chance of amputation. Yet it is plainly our duty to permit no anticipation of such untoward consequences to influence the care and attention bestowed on our management of the case. Let our treatment be, if possible, more painstaking than in ordinary circumstances; and it may be that our care is rewarded by a prosperous conclusion.

During the attempted cure much judgment is required, in both general and local management. Locally, we wish by bandaging and splints to keep the fragments in close apposition, and absolutely immovable. Constitutionally, we are desirous of supporting the vis vitæ; by generous food and other tonics, perhaps freely administered. But to follow out these indications, blindly and with rashness, is almost certainly to induce chronic gangrene of the extremities; analogous to one form of the gangræna senilis; inflammation occurring in a part and system both of much diminished power. The bandage and splint must be only moderately tight; the diet must be nutritious, yet non-stimulant; the effects of both must be carefully watched; and should gangrene appear, notwithstanding all our care, the fracture must for a time be comparatively disregarded, and our attention mainly directed to the mastery of the more serious malady, according to the principles formerly detailed (p. 251).

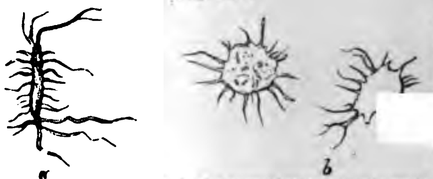
When fracture has occurred in consequence of the cancerous diathesis, often a malignant tumor forms at the site of injury, instead of the normal callus. But that result is by no means invariable; and therefore, even in those unpromising cases, our treatment should still be the same; even more careful than in ordinary fracture (p. 285).

MOLLITIES OSSIUM, OR OSTEOMALAKIA.

Both this disease and rickets are characterized by a deficiency; actual and relative, of phosphate of lime. In mollities ossium, the skeleton, originally of normal structure, parts with its earthy matter; becoming soft and pliable in consequence. And in this respect there is a manifest difference from rickets; in which the osseous structure is abnormal from the first, or at all events from a very early age. In rickets, also, softening and flexion are slow and gradual; while in mollities ossium, the morbid progress is rapid, and distortion may be both speedy and great. Further, in rickets, after a time, the abnormal condition is departed from; earthy matter comes again, in even more than its due proportion; the skeleton grows solid and unyielding; and the general health may be in a great measure restored. In mollities ossium, the untoward condition is usually steadfast; there is no amendment in the state of either health or skeleton; and the disease, sooner or later, almost always proves fatal. Again, the one disease is most common in childhood; while the other is peculiar to maturer years. Mollities ossium occurs more frequently in females than in males; happily, however, it is a rare affection in both. Rickets, on the contrary, seems to have no predilection for sex; and is extremely common.

In mollities ossium, loss of earthy matter is both rapid and great; a copious phosphatic deposit is found in the urine; and the bones come to consist almost entirely of oily matter held in membranous tissue. Indeed, the state of the osseous tissue differs, apparently, but little from that of fragilitas ossium; except in retaining still less of the earthy matter, and sometimes almost none at all. Mr. Dalrymple has found by microscopic observation that the bone corpuscles are considerably enlarged.[1] The general health is much and hopelessly impaired; flesh, spirits, and strength dimi[illegible]ng daily. The bones are [illegible] soft, and greasy; and ultimately may come to consist of a thin external shell, filled with soft matter; partly lardaceous, partly oily. Sometimes much pain attends; in other cases the unfortunates suffer little or no inconvenience. In one remarkable instance, related by Mr. Howship, a sense of tightness and much pain were complained of, at one particular spot; and there, on dissection, marked constriction and depression of the softened bone were found.

Fig. 137.

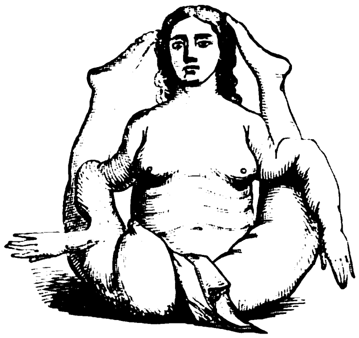


Bone corpuscles; a, in the normal state; b, enlarged, as in mollities ossium.—DALRYMPLE.

The disease may affect the whole skeleton; or may be limited to several bones, or to one. The pelvis may suffer alone; and is distorted peculiarly. The heads of the thigh bones, pressing against the acetabula, squeeze the sides of the pelvis inwards and upwards; while the sacrum is projected downwards. In rickets, on the contrary, the front wall of the pelvis is generally flattened, and the bones are of unnatural proportion and size as well as shape. In rickets the pelvis is both stunted and deformed. In mollities ossium, the bones are of their natural bulk and proportion; and if their "various doublings were unfolded," the pelvis would be restored to its normal dimensions and form.[2]

The cause of mollities ossium is still involved in obscurity. Loss of blood, mercurialism, and whatever depresses constitutional power, are believed to predispose towards its occurrence. It is most common in the large manufacturing towns in England. In the case of Madame Supiot—a memorable example—the eating of much salt was a prominent peculiarity; which some were inclined to specify as a cause; but it seems to have been rather an accessory of the general perverted state, than its origin.

Fig. 138.



Madame Supiot; in a posture quite practicable in the advanced stage of the disease.

The disease is, according to present experience, incurable. As in other affections of a like nature, little more can be effected, in treatment, than palliation of the more prominent and distressing symptoms.

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[1] Dublin Quarterly Journal, August, 1846, p. 85.

[2] Stanley on the Bones, p. 238.

RICKETS.

As formerly remarked, this is a vice of the skeleton, peculiar to early years. "In some instances, it has begun immediately after birth. It rarely, however, appears before the fifth or sixth month; and the most frequent period of its commencement is between eighteen and twenty-four months. It very seldom commences after puberty."[1] It is attended, from the first, by a marked cachexy of system, which seems to be identical with the scrofulous. Usually, however, this becomes abated, after a time; even independently of remedial treatment. And, cotemporaneously with amendment of the general health, the abnormal condition of bone also disappears; a fact which has most important bearing on the treatment, and which should therefore be borne constantly in remembrance.

The bone is found changed in structure. The dense laminated texture is almost entirely removed; barely enough being left, sometimes, to constitute a thin outer shell. Cancellous texture, consequently, largely predominates; of a brown or reddish hue, soft, compressible, and at first filled with a serous fluid; in some cases a sanious liquid may be squeezed out, as if from wet leather. After some time, a gelatinous substance occupies the tube and cancelli; and this, becoming organized,

Fig. 139.

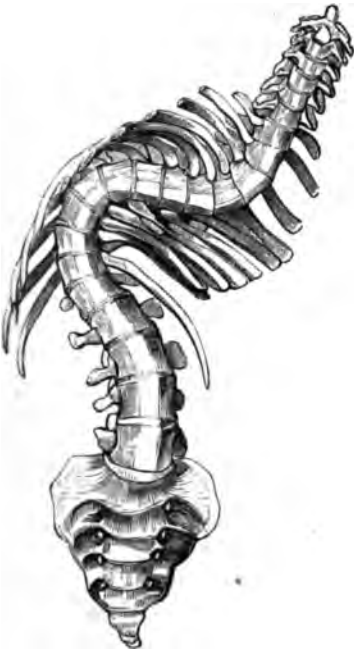
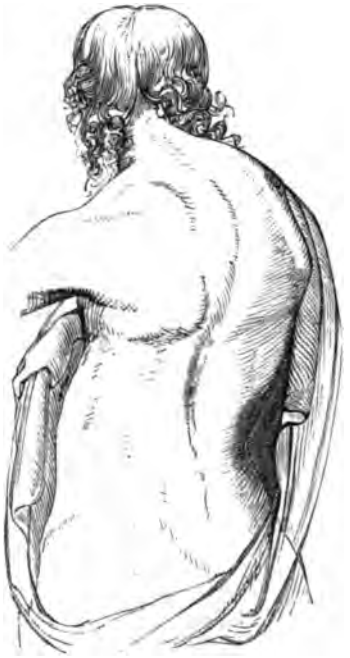


Fig. 140.



Permanent curvature of the spine, with rotation, produced by Rickets.

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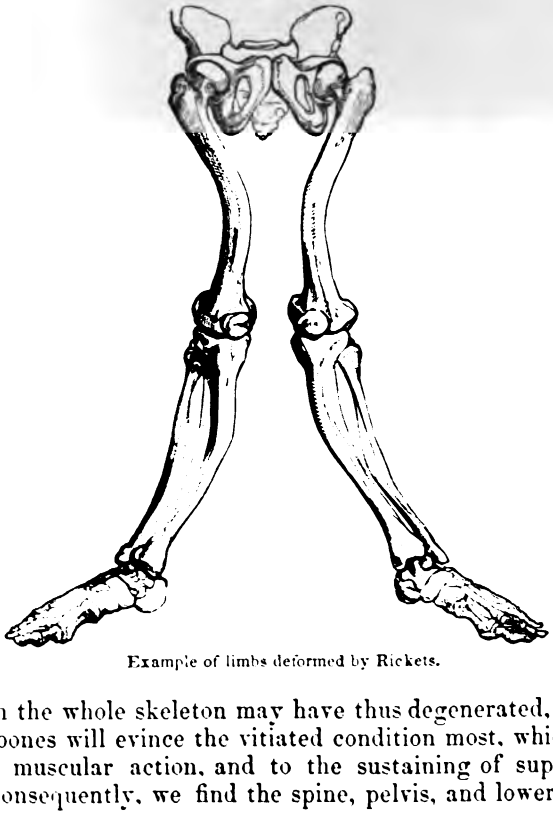
[1] Stanley on the Bones, p. 218.

passes into a cartilaginous state. The whole bone is soft, easily cut with a knife, and preternaturally flexible. It has parted with its earthy elements. The animal matter too is changed, as well as the earthy; for the extract obtained by boiling does not yield either chondrin or the gelatine of bone. And, besides all this, comparative arrest of growth takes place; as is seen especially in the lower limbs.

Sometimes the entire bone is expanded, even to a great extent; the calvarium, for example, being in some cases found of more than double its usual thickness, and seeming to consist almost entirely of diplöe. Sometimes atrophy is the prominent change. In all cases, whether atrophy or expansion exist, the bone will be found much lighter than in the normal state. The flat bones are, perhaps, more frequently thickened than otherwise; the long bones, usually, are atrophied in the shaft, while they show hypertrophy of the articulating extremities. Such enlargement, however, is often more apparent than real; depending mainly on wasting of the shaft and its soft coverings. According to Mr. Stanley, actual expansion occurs only in those joints which are superficial; as the wrist, elbow, knee, and ankle. In all cases, epiphyses are more loosely connected than in health.

Fig. 141.



Example of limbs deformed by Rickets.

Although the whole skeleton may have thus degenerated, it is obvious that those bones will evince the vitiated condition most, which are most exposed to muscular action, and to the sustaining of superincumbent weight. Consequently, we find the spine, pelvis, and lower limbs, most prominently distorted. The former may be bent forward, or to the side; usually the curvature is lateral, with more or less rotation of the bodies of the vertebræ. These become interstitially absorbed, at the concavity of the curve—on the front or side, as the direction may happen to be; while, on the convexity, the articular processes become both thickened and enlarged. Antero-posterior bending has occurred to such an extent as to cause doubling of the aorta, adhesion of the opposed coats at the folded part, and consequent mal-nutrition of the lower limbs. The thighs and legs may have their natural curves merely exaggerated; or they may be bent in a variety of fantastic ways. Their bones, however, are not only bent but flattened; and, fortunately, the greater diameter of the bone is antero-posterior in relation to the curve; consequently, they are not so weak as they otherwise would be. The heads and necks of the thigh bones bend downwards; and may ultimately come to be on a lower level than the trochanter. Arrest of growth, too, is strongly marked in the lower limbs; imparting dwarfishness to the frame, as well as distortion. The articulating ligaments also fail; and deformity of the knee and ankle-joints ensues. The pelvis is small; its front wall is flattened, and forced back upon the sacrum. And a characteristic hollowness is imparted to the loins, by the sacrum being thrust downwards; its promontory becoming unusually salient, and its posterior surface forming the bottom of a hollow on the back part of the pelvis. At the same time both ilia are displaced backwards, so as to overlap the sacrum and approach each other; sometimes leaving scarce an inch of space between their posterior borders.

The ribs follow the spinal distortion, variously accommodating themselves thereto; usually so as to produce a marked, and even sharp prominence of the chest; which is greatly contributed to, by a bending forwards of the sternum. The clavicles have their natural curves increased. The scapulæ are not much changed; except in showing enlargement of the articulating surfaces. The bones of the arm and forearm are twisted, more or less; but retain much more of their normal character than do the lower extremities; the one set having to bear muscular effort alone, while the other has to contend with both this and superincumbent weight.

By alteration in the important visceral cavities, breathing is oppressed, and the assimilating organs are more or less embarrassed; usually the abdomen is preternaturally prominent. The stature is stunted, dwarfish, and unseemly. Besides, there are the usual characteristics of the scrofulous diathesis. In the child the forehead is remarkably prominent; and though the entire head is usually below the standard dimensions, yet from still greater deficiency of growth in the bones of the face, the cranium seems unusually large.

The features are marked, and developed with an unpleasant fulness; the general expression of face is displeasing, and altogether so peculiar as to be almost pathognomonic of the general disease. Although there may be unusual thickness of the skull, yet this is to be understood only in its literal sense; for often the intellectual power is vivid and great.

The predisposing cause of rickets, as formerly stated, seems to be a vitiated state of system, analogous to that of scrofula. Frequently, the exciting cause is some of the debilitating accidents incidental to childhood; as dentition, or some of the host of infantile disorders therewith connected. Often, the change in the skeleton is first observed on the child's attempting to walk; and then the primary deformity is of the lower limbs, chiefly below the knee. The knees approach each other, the ankles diverge, and the shins curve forwards over the ankles; a very different kind of bending from the ordinary bandy appearance, or mere exaggeration of the natural tibial curve, which so often occurs in the heavy but healthy child, who, perhaps prematurely, has begun to struggle into the erect posture. After the lower limbs, the spinal column begins to yield; and then follow the other component parts of the skeleton; the multiplicity of bones affected [illegible] of the characteristics of this constitutional disorder, and serv[illegible] inguish it from curvature of single bones—of the spine more especially—which do not depend on rickets, or any other vice of the general system.

In the case of the spinal column, it is most especially important to remember, that many examples of its bending are independent wholly of rickets. And that those cases alone are rickety, in which the system is plainly and primarily cachectic; and in which the deformity, by bending, is not limited to the spine alone, but affects other bones as well; more especially the ribs, pelvis, and lower extremities. This is a practical point which will be more fully dwelt upon, when treating specially of spinal curvature. Meanwhile, the points of diagnosis may be here shortly stated. Rickety curvature is comparatively rare in the better classes; it affects both sexes alike; it occurs in early years; it is accompanied with distortion of the pelvis and lower limbs. Other curvatures, not rickety, are most common among the affluent and among females; are most frequent between the ages of ten and sixteen years; distortion is confined to the spine and ribs; and there is not the same character or extent of constitutional cachexy as in rickets.

As the rickety patient advances in years, the disease does not proportionally become more marked, as is usually the case with mollities ossium. But at, or after puberty, if not before, phosphatic deficiency is found to cease; the general health amends, flesh and color are gained, the spirits rise, motion is more sought and better performed, the skeleton is found to be hardening in its texture; nutrition has begun to be restored, and is gradually approaching the healthy standard. If means, suitable and successful, have been adopted ere this to undo the curves and restore straightness and symmetry of form, such firming of the skeleton is an unqualified boon. But if, as is not unlikely, remedies have been either wholly absent or imperfect in their operation, there results an irrevocable confirmation of the existing deformity.

This, however, is in some degree ultimately atoned for. The general health is regained; as also power of motion to a certain extent. The muscular fibre becomes fully developed, and the muscles adapt themselves to the shortened and bent bones. The bones, though misshapen, are strong; and yield no longer, to either muscle or weight. They contain, at least, the normal proportion of earthy matter; and, besides have been strengthened in their curves by new bone deposited, sometimes copiously, in the concavity. The pelvic and thoracic viscera accommodate themselves to the altered circumstances of their including skeleton. And thus, the patient though perhaps a confirmed and unseemly dwarf, weak and puny in his boyhood, may, notwithstanding, prove a healthy, muscular, and tolerably active man.

Treatment.—The treatment of rickets must be mainly directed towards amendment of the general system; as is plain from a consideration of the nature and cause of the disease. And, the inductive cachexy seeming to be identical with the scrofulous, a general treatment will be expedient, regarding diet, exercise, clothing, tonics, &c., similar to that formerly recommended as tending to subdue the strumous diathesis, and to prevent establishment of local strumous disease (p. 56). Friction of the general surface is of use; improving the skin, and at the same time promoting muscular development. Muscular exercise, too, will assist in fulfilment of the latter indication; but it must be both gently and briefly practised, otherwise the skeleton cannot fail to have its distortion increased thereby. Absolute confinement to the supine posture will do more harm than good; by aggravating the constitutional debility, and general disorder. But its occasional use, for an hour or two at a time, or even for that period only which is usually allotted to waking repose, will be found of much service; relieving the weak spine, and lower limbs, from the weight imposed by the erect and semi-erect postures.

If the spinal column continue to bend, notwithstanding persevering use of suitable constitutional remedies, and relief by posture, light mechanical support becomes essential. Not by the heavy cumbrous stays, ordinarily employed, at least in times not long bygone; an apparatus under which it would require the strength of a stalwart man-at-arms to move with comfort; and the miserable effect of which, on the delicate and weak patient, must ever be in the highest degree disastrous. But by a light and easy adaptation of mechanics, such as the well-informed modern artist now supplies; the object of which is to relieve the spine from the weight of the head, arms, and trunk, by taking it upon itself; without cramping the muscles by a tight unyielding embrace; or causing lassitude, fatigue, and absolute pain, by an unwieldy and overpowering encumbrance. The principle of construction is simple; light steel rods, supporting weight between the axillæ and the pelvis, and leaving the spinal column free.

In the use of all mechanical supports, however, let the soft and yielding state of the whole skeleton be remembered; so that we may if possible, not only relieve the parts most oppressed, but also do no harm, by undue compression, to those parts on which the duty of support is temporarily thrown. It would be but a bad result, in attempting to straighten the spine, to crush the pelvis.

When the lower limbs are but little bent, in the puny child, and the rickety condition is scarcely yet fully developed, no mechanical apparatus should be adapted. The general treatment is to be earnestly employed; moderate exercise is to be encouraged, the patient should be much in the open air, and diet should be free and nourishing. And generally, in such cases, the little patient, in common phrase, grows out of the deformity; the limbs spontaneously resuming strength and symmetry. But when curvation is great, and in other respects the rickety indications undoubted, light apparatus are certainly expedient; as fulfilling three salutary indications; preventing increase of the deformity; diminishing that which has already occurred, by applying reducing power in the required direction and degree; and enabling out-of-door exercise to be enjoyed, much to the advantage of the general health, and yet without prejudice to the limbs. And, in regard to this orthopœdic treatment, let it always be remembered, that the time for its application is but limited. That if the present opportunity be not improved, the period is probably fast approaching, when, by a complete change in the diathesis, the bones become no longer pliable and yielding; but, resisting all remedial efforts, have their deforming curves permanently confirmed. The suitabl [illegible] cal apparatus need not be minutely described. The details [illegible] vary, in almost every case. The principles of their construction, and the superintendence of their use, constitute the surgeon's duty; the rest is left to the skilful and intelligent machinist.

In curvature of the spine, not of rickety origin, but depending on either muscular debility, or awkwardness of muscular play induced by careless and improper attitude, benefit is sometimes obtained by maintaining the strictly erect posture, during a certain number of hours in the day; and by the poising of a light weight on the crown of the head. But, in rickets, ponderation of any kind will tend to prove an adjuvant, not of the cure, but of the disease. The principle of the former is not the imposing, but the abstracting of weight from the enfeebled column of support.

To the rickety female, celibacy should be strictly enjoined; for, unfortunately, an "aptitude for conception" often exists, along with pelvic change and other circumstances extremely hostile to parturition.

Phosphate of lime has been given internally, in a sustained course of large doses; but obviously with a lack of wisdom. There is no want of earthy matter in the system, but only in the skeleton; and, as yet, we have got no means of directly precipitating lime either upon, or into, the living osseous texture.

A chemical view of the nature and treatment of the disease has lately been broached. "Phosphate of lime is eliminated in large quantities with the urine. This salt, otherwise little soluble, and discharged generally only in small quantity by the kidneys, is, according to Berzelius, readily soluble in lactic acid. Anything, therefore, which causes a superabundance of this acid in the system, is capable of depriving the organism of a large share of the earthy matter of the bones. Sugar of milk, grape sugar, starch, and gum, are readily converted into lactic acid; but they are so, in the stomach, only when digestion is ill-performed; in which case, lactic acid may be an abundant product in the system. Rickets and mollities ossium therefore . . . . may be the results of imperfect digestion and nutrition; to improve which, is consequently our first indication. None of the substances readily converted into lactic acid should be taken; as sugar, starch, gum, &c.; nor even milk. But animal food should be chosen, and such other as is of easy digestion; in aid of which, we ought to employ such medicines as may restore the general tone of the system."[1]

[1] [illegible]

According to this view, scrofulous children may perhaps be saved from the accession of rickets, by early weaning; and by careful attention to other diet—less prone to acid, yet equally nutritious.

TUMORS OF BONE.

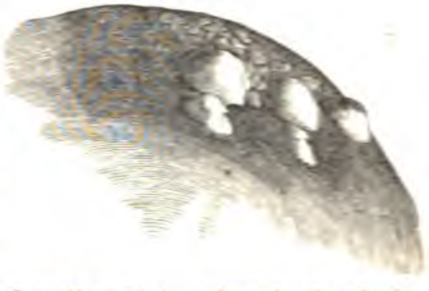
These, like tumors of the soft parts, are simple and malignant, analogous and heterologous. The great majority are included in the following classification. *Exostosis*, *Osteoma*, *Enchondroma*, simple; *Osteosarcoma*, at first simple, but tending to degeneration and malignancy; *Osteocystoma*, analogous to the encysted tumor of the soft parts; *Osteocephaloma*, *Osteocarcinoma*, *Osteocancer*, *Osteomelanosis*, malignant; *Osteoaneurism*, or *Vascular tumors* of bone, troublesome and tending to disaster, sometimes associated with malignant structure.

Exostosis.

By this is understood a growth from bone; of osseous structure, analogous to that from which it has sprung; and following the same course of formation as in original ossification. A plasma is exuded, and becomes organized; then it passes into transitional cartilage; and thence the osseous structure is gradually completed. At one time, the term was made to include all growths; fleshy, osseous, and cartilaginous. But, with propriety, it is limited to growth of bone from bone. There are varieties.

1. *The Dense or Ivory Exostosis.*—This is most frequently found in the flat bones, especially the calvarium. It consists of dense laminæ, firmly compacted; incorporated with the dense external portion of the parent bone, to which it is quite analogous; usually of smooth and polished surface; its outline forming the segment of a comparatively large circle; and the size seldom exceeding that of a nut, bisected. Growth is very gradual and slow, and altogether painless. When superficial, as on the skull, external form is interfered with; and that constitutes the chief inconvenience. Sometimes, its origin may be remotely connected with external injury; more frequently, there is no assignable cause. No treatment is required. Were the formation to take place on the internal aspect of the calvarium, serious disorder of the cerebral functions would probably ensue; and removal by the trephine would be expedient, were accuracy of diagnosis attainable. But, fortunately, such an event seldom if ever occurs. Bone, it is true, sometimes projects from the interior of the skull, and entails the most serious consequences; but it is of the spiculated, not of the flat and dense character.

Fig. 142.



Several ivory exostoses, clustered on the os frontis.

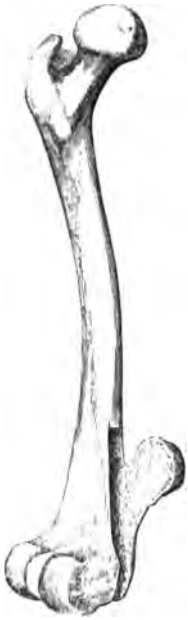
2. *The Cancellated Exostosis.*—A minor and adventitious bone, of irregular form, projecting from one which is primitive; structurally

similar, in all respects, to its parent; having both an external laminated portion, and internal cancelli; the latter either continuous with the cancelli of the larger bone, or shut off by its external laminated portion. In other words, sometimes the exostosis seems to be deposited on the parent bone, like the first variety; but more frequently, it seems to grow out of it. However arranged, it follows the usual course; first cartilage, then bone. And the exostosis, as it grows, is usually surrounded by a cartilaginous margin. When the extreme of growth has been completed, and the tumor remains stationary, then all is found osseous.

This kind of exostosis seldom occurs but in the long bones of the extremities; and is most frequent in the femur at its lowest part. The cancellated texture usually predo[illegible] the external laminæ being thin and delicate. But in some ca[illegible]owth is dense; especially at the neck or origin. There is an investing continuation of the periosteum; and this, usually, is separated from the muscular and other tissues by a serous-looking investing cyst.

Sometimes the attachment is by a narrow neck. And however narrow this may be, it is supposed that it does not enlarge with the rest of the tumor; increase taking place only on the latter's circumference. Still, the usual form partakes more of the cylindrical than of the pyriform.

Fig. 143.



Cancellated exostosis; growing from its most frequent site, the lower part of the femur; and, as usual, inclining upwards. *After* DRUITT.

This fact, of non-enlargement at the point of attachment, has an important and obvious practical bearing, as regards removal of the formation.

In some cases, the size is small, and occasions little or no inconvenience; in others, the exostosis projects several inches among the muscles of the limb, greatly impeding their function. Sometimes the tumor, though small, produces serious inconvenience by pressure on important parts. Growing from the first rib, it has displaced and flattened the subclavian artery; simulating aneurism. Growing from the lower cervical vertebræ, it has compressed the same artery, and caused gangrene of the limb. Of similar origin, it has [illegible]mpressed the œsophagus, producing dysphagia. Growing from the odontoid process, it has caused fatal pressure and softening of the spinal cord. Projecting backwards from the pubes, it has caused retention of urine, and even produced organic change in the bladder. Growing inwards from the cranium—fortunately a rare event—it has occasioned epilepsy.[1]

Increase is more rapid than in the ivory exostosis; but still slower, and more insensible, than enlargement of an inflammatory kind. The growth of no form of exostosis is associated with the inflammatory process. Their origin, like that of other tumors, may be remotely connected therewith; but their formation is by a more simple perversion of the nutritive function (p. 262).

Some of these exostoses may be traced to a blow, or other external injury. Pain and swelling ensue, of an inflammatory character;

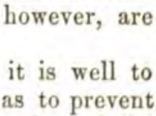
the inflammatory process and its pain subside, but the swelling remains; resolution is incomplete; and subsequently the enlargement is continued, of a circumscribed and prominent character. Not unfrequently, the exostosis is found at the site of a muscular insertion, where a process of bone naturally exists; and, by the play of that muscle, it may be supposed that an exaggeration of the normal process into an abnormal exostosis is gradually produced. In some cases, an ossific diathesis may be said to exist; even a slight blow being followed by an exostotic formation. Such cases, however, are rare. The skeleton, so susceptible, is prone rather to inflammation, and its results; abscess, ulcer, caries, and necrosis.

In the majority of cases, this variety of exostosis may be left undisturbed. Interference is only warrantable, when bulk and position are such as to interfere with important functions—as of muscles, vessels, cavities, canals, or internal organs. Then, an incision may be made, the neck of the growth severed by a saw or bone-pliers, and the exostosis carefully removed. Cases demanding such treatment, however, are comparatively rare.

When a fleshy part is operated on, such as the thigh, it is well to make the wound more or less transverse in direction; so as to prevent outward accuracy of approximation, and consequent retention of the suppurative discharge (p. 298). Also, no stitches or plaster are used, with a view to primary union. For the wound invariably inflames acutely; pus forms rapidly and profusely; and the serious dangers, local and constitutional, of confined and consequently infiltrated purulent secretion, become imminent, unless the wound is patent and free. Patients have not unfrequently perished from the results of this operation. And, in consequence, as already stated, it is not to be resorted to as an ordinary and innocent procedure. Besides, it is to be remembered that an exostosis may spontaneously cease to grow; as if having exhausted its cartilaginous supply. And then, if not of large size, or very awkwardly situated, it will be productive of but little inconvenience.

A small exostosis, protruding from the distal phalanx of the great toe, is not uncommon; and generally causes so much lameness, and other inconvenience, as to require removal. Generally it is sufficient to take away the exostosis alone; but in some cases it is necessary to remove the phalanx also, either in whole or in part.

Fig. 144.



Exostosis of distal phalanx of great toe.

Sometimes, by external injury, an exostosis sustains fracture. Inflammation is then apt to be lighted up; the fractured portion dies; and acute suppuration takes place around. Under such circumstances, incision is required; free enough to permit not only evacuation of the abscess, but also removal of the necrosed portion.

Repeated injury may fail to produce fracture, but may cause degeneration, even of this simple structure, into a soft and malignant growth; demanding ablation of a more extensive and formidable kind.

Osteoma.

Exostosis is a growth of bone from bone. Osteoma is an enlargement of the bone itself; hypertrophy, accompanied with great condensation of structure; and unassociated with the inflammatory process—therein differing from node. The enlargement is very gradual, and unattended by pain. External injury may be the apparent cause; or no cause may be assignable. In any part of the skeleton, it is comparatively rare; but the long bones of the extremities, and the lower jaw, may be reckoned its usual sites. The size is seldom great. A section discloses density of structure; excepting perhaps a little portion of cancellous texture in the centre.

This affection of bone is, originally, most simple; and may long remain so. Yet it is liable to degenerate; either in consequence of repeated injury, or on account of an evil disposition having crept into the general frame during the adva[illegible]rs. I have seen a section of such a tumor, dense and osseou[illegible]ut, except just at the centre; where an open space not larger than to enclose a small nut, instead of being occupied by cancellous texture—as it, no doubt, originally was—contained a distinctly cerebriform substance. Early treatment, therefore, is highly expedient.

In the first place, arrest of growth and discussion are to be attempted by the ordinary means; for this tumor of bone is analogous to the simple sarcoma of soft parts, and amenable to absorption—when recent and small. Failing discussion, extirpation is to be had recourse to; by the knife and saw. And when the site is unsuitable for extirpation, amputation is expedient. For, though the tumor be simple and safe for a time, no one can tell when it may begin to degenerate; then demanding operation under much more inauspicious circumstances.

Enchondroma.

This is a cartilaginous growth, connected with bone; "a retrograde transformation of bone into cartilage;" peculiar to early years; and usually attributable to external injury. The form is spheroidal; the size sometimes equals, but seldom exceeds, that of an orange. The tumor here figured (Fig. 145) is of unusual size; it weighed fourteen pounds. It was removed by amputation at the wrist.

Growth is slow and painless; and the surrounding textures are not involved, but pushed aside. The nature of the tumor is strictly benign; and there is little tendency to degeneration, even when, after many years' duration, ulceration of the investing integument may have occurred. In the case already alluded to, growth had been long continued, the size was very great, and ulceration of the surface was extensive. Repeated hemorrhages, too, had occurred; and the patient looked cachectic. Nevertheless, section of the structure showed nothing but purest enchondroma. At the same time, cases, though few, are on record, in which degeneracy seems to have begun; the interior of the tumor softening and breaking down; the surface ulcerating, and discharging fetid sanies from the centre.

All parts of the skeleton are liable to the formation; but it is most frequently found in the metacarpal bones and phalanges of the fingers. The articulating cartilages are not involved, but form the limits of the growth in that direction; and adjacent tumors have no tendency to coalesce, but rather remain distinct. Occasionally, several tumors are simultaneously developed; the result not of a constitutionally malignant cause, but rather of "the widely spent influence of the exciting cause, which in most instances, is a contusion."[1]

The structure consists of two parts; a fibro-membranous interlacement, forming cells of different sizes, some equal to that of a pea, within which is contained the cartilaginous matter. This is softer than true cartilage; "more nearly resembling in consistence, the soft hyaloid cartilage of cartilaginous fishes." The general appearance of the section's structure is strikingly conglomerate; and in consequence slight inequalities are usually imparted to the surface of the tumor.

There are two varieties. 1. The adventitious growth is developed in the interior of the bone. The formation gradually takes place in the cancellous texture; and the external portion, or shell, proportionally dilates. This outer shell, though attenuated by distension, yet receives addition of new osseous matter from time to time; and long retains its continuity. Ultimately, it becomes very thin, and in some places membranous; still the tumor retains its smoothness and spheroidal shape. This variety, then, is invested by both bone and periosteum; and it is that which most frequently occurs.

2. The second variety is formed on the exterior of the bone; and is covered only by the periosteum and other soft parts. It is generally met with in the flat bones; cranium, pelvis, and ribs. The interior of the tumor is the same as that of the preceding; the form is less regularly spheroidal, and the surface is more unequal.

Treatment.—When enchondroma is very small and recent, there is some reason to believe that discutients, such as mercury and iodine, may not only check, but gradually disperse the tumor. In the great majority of cases, however, though this be little disposed to degenerate, still it is in no way amenable to absorption; and therefore it demands removal by the knife. The first variety, external to the bone, is simply dissected away; the bone remaining entire. The second requires ablation of that portion of bone from which it is produced. And if removal have been complete, reproduction need not be anticipated.

Fig. 145.

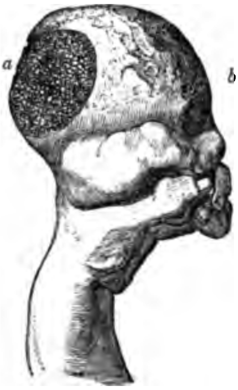


Fig. 146.

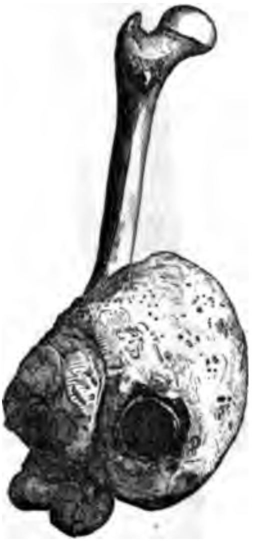


Fig. 145. The large enchondroma referred to. At *a*, a section made to show structure. At *b*, the ulcerated surface, whence the bleeding came. For the microscopic characters, see page 277.

Fig. 146. Osteocystoma, of large size; occupying lower end of femur. Prep. in University Museum.

Osteocystoma.

This has been already considered, and the points of difference shown between it and chronic abscess (p. 377). The contents are not purulent, but serous, or of a glairy or gelatinous character. The cyst is not a pyogenic membrane; but a structure analogous to that of the encysted tumor. Growth is slow; but the bulk acquired may be enormous.

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[1] Müller.

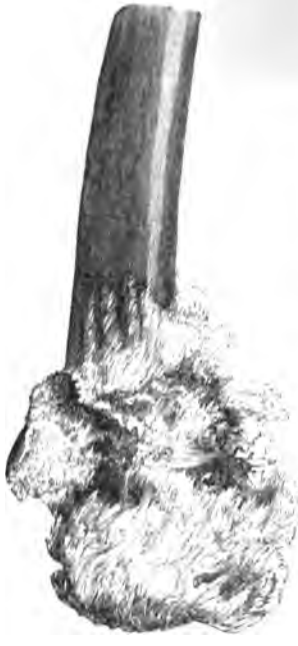
For the smaller of such tumors—small not only in themselves, but also in relation to the bone from which they spring—evacuation by opening and counter-opening will suffice; pressure being also applied, so as to favor contraction and consolidation. In the larger, it is better at once to amputate the affected part.

Osteosarcoma.

By this is understood a tumor [illegible]artly of bone, partly of fleshy substance—as the name implies; [illegible] constituent of a simple and non-malignant kind. The formation is us[illegible]lly attributable to external injury, perhaps slight; and originates in the [illegible]ancellous texture of the bone. The osseous part is analogous to the fibrous interlacement in tumors of the soft parts. It is, as it were, the stroma in which the other constituent is deposited: dense and solid centrally; radiating in spicula outwards, which diverge and interlace—leaving interstices, more or less wide, in which the fleshy substance is lodged.

The interstitial structure is of different kinds. In some cases, it is partly cartilaginous; in others, of a fibrous character, or resembling the simple sarcoma; in others it is cystic. Most frequently, it is composed of sarcomatous substance, containing occasional points of cartilage. Cells, too, are usually found; being probably certain of the interstices, dilated, and unoccupied by solid matter; filled with fluid, sometimes glairy and clear, sometimes serous and turbid. They are seldom of large size, but may be numerous.

Fig. 147.



Osteosarcoma of the lower part of the femur; macerated. The fleshy part of the tumor removed, the spiculated osseous stroma remains.

Being lined by a secreting membrane, these cysts constitute the most dangerous part of the tumor. On perversion of their function, degeneration would seem to depend.

In proportion as this growth in the interior of the bone is developed, the exterior shell becomes expanded. And, as in enchondroma, the latter for a time retains its continuity, in some places even with an increased thickness, by new osseous deposit; but, ultimately, at certain points—and these are usually towards the external surface—it becomes first thin and pliable, as parchment, and then entirely membranous. Even the membrane, after a time, gives way, and the superimposed soft parts, too, may tighten, inflame, and ulcerate, thus exposing the true structure of the morbid growth. But no sprouting fungus results, no hemorrhage, no fetid ichorous discharge. The discharge is purulent and moderate; the sore is simple; and cicatrization may be effected.

Growth is more rapid than that of osteoma; but infinitely more slow than that of osteocephaloma. Many months may have elapsed, and the tumor may still be no larger than an orange. Pain can hardly be said to attend; yet there is more inconvenience and discomfort felt, in and around the part, than in the simpler and more tardy formations of exostosis and osteoma. Pressure does not increase pain materially, if at all. When made firmly, a crackling sensation is often experienced; partly from displacement of the parchment-like portions of the osseous shell, partly from interference with the radiating osseous skeleton of the mass. The sensation of firmness, imparted to the touch, is less than that of exostosis or osteoma; much greater than that of osteocephaloma. There is no elasticity; and the presence of fluid accumulation is not simulated. There is little or no constitutional disorder; unless important function be interrupted, by the bulk and position of the tumor. Often the patient seems to be, in all other respects, of even robust health.

This tumor seldom appears before adult age. It is originally simple, and may long remain so; but it is prone to degenerate from slight causes, local or constitutional. Rapid growth, great pain, open condition, fungous protrusion, involvement of surrounding parts, and marked constitutional cachexy, often supervene after the infliction of but a trifling injury. Early removal, therefore, by operation, is in the highest degree expedient; while yet the tumor is small, and the wound may be slight and safe; while yet the structure and tendency are simple, and immunity from return may be secured.

When a long bone is affected by osteosarcoma, in its shaft, as but seldom happens, fracture at that point is not unlikely. After such a casualty, amputation is imperative. There is no chance of reunion; and rapid enlargement, with avowed malignancy of the tumor, is certain and inevitable.

Osteocephaloma.

This denotes the medullary formation as it occurs in bone; a most malignant and intractable tumor; and, unfortunately, not of rare occurrence. When osteosarcoma degenerates, it is to assume the characters of this. Then, instead of fleshy interstitial substance, of a simple kind, there is medullary deposit; commencing usually at a central part. The osseous skeleton for a time remians; but sooner or later it disappears, and its place is occupied by a soft brain-like mass. The exterior osseous shell, in like manner, is involved and changed; ulceration follows; the medullary substance, then exposed and unconfined, quickly establishes the condition of fungus; and an untoward progress is made, similar to what has been already described in the soft tissues (p. 290). More frequently, the tumor is primary. Medullary from the first; making no change, except from the occult to the open state, and perhaps to assume the condition of fungus hematodes; rapid, painful, involving all textures, pushing none aside, and attended by a most marked and wasting cachexy. Sometimes the brain-like mass originates in the soft textures exterior to bone, and involves the latter secondarily. And in some cases, portions of fat have been found coexistent with the medullary matter.

Fig. 148.

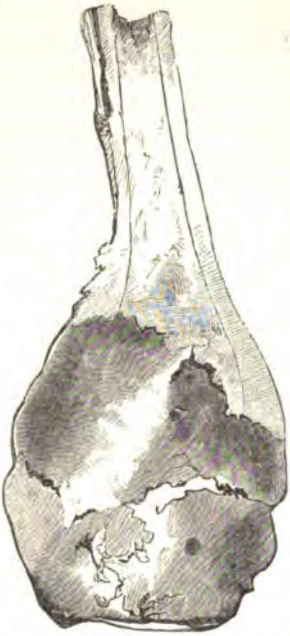


Fig. 149.

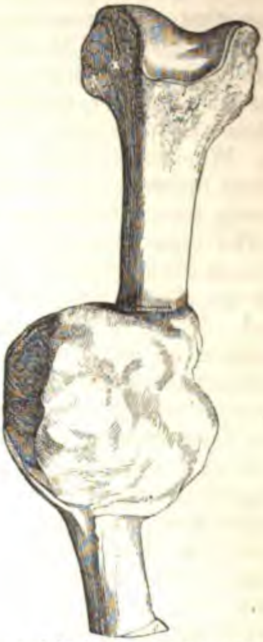


Fig. 148. Section of Osteocephaloma affecting the lower part of the femur; a very common site. The whole bone at that part is converted into a pulpy brain-like mass. Fig. 149. Osteocephaloma of the femur, near its middle. Fracture occurred previously to amputation. Patient recovered.

When the tumor forms in the shaft of a long bone, fracture is still more likely to occur than in osteosarcoma; greatly aggravating the untoward progress of the disease.

Treatment is by early and thorough removal. Amputation of the limb is usually preferable to extirpation of the part; and it is a safe general rule, that, when practicable, the bone in which the tumor has been produced should not be sawn through at any part, but disarticulated. If an opportunity for early interference be not afforded, the knife should be withheld, and palliatives alone employed.

Diagnosis.—Practically, it is of the utmost importance that we should be able to distinguish between osteosarcoma and osteocephaloma. Each is of not unfrequent occurrence; and each requires distinct rules of treatment. The most common sites of each are the maxillary bones, lower and upper; and next, the long bones of the extremities, especially the heads of the tibia and fibula, and the corresponding end of the femur. But the flat bones, as the scapula, cranium, and pelvis, are by no means exempt. Nay, in some cases, the whole skeleton seems more or less affected with the malignant diathesis.

The prominent points of difference are the following: sufficiently distinct to protect the experienced and careful. In the degenerating tumors, however, it is often not easy to determine whether the simple or malignant structure yet predominates.

1. Osteosarcoma is seldom found prior to adult age; Osteocephaloma may occur at any period, and is as frequent in the adolescent as in the adult. 2. Osteosarcoma is usually attributable, in its origin, to external injury. Osteocephaloma is more frequently of spontaneous growth. 3. Osteosarcoma is slow and gradual, and more or less uniform in its growth. Osteocephaloma is much more rapid, and tends to enlarge unequally; growing chiefly at those points where there is least mechanical resistance. 4. Osteosarcoma, usually, is almost, and sometimes altogether, painless; unless when some nervous trunk or plexus is compressed. Osteocephaloma, from the first, is attended with severe lancinating pain. 5. Osteosarcoma is firm, and yields but little to the touch; even rude pressure is scarcely painful; an obscure crepitus is often felt. Osteocephaloma is soft and elastic, from an early period; the shell of bone, and all other remains of the original texture, soon becoming merged in the medullary formation. It is elastic, and affords no crepitus—when an original tumor; and pain is aggravated by even slight compression. 6. Osteosarcoma entails but little disorder of the general health. Osteocephaloma is attended with marked cachexy, even from the beginning. 7. A casual abrasion of the skin, or mucous membrane, investing an osteosarcoma, shows a simple character; and may be brought to heal, under ordinary treatment. A similar breach, in the surface of an osteocephaloma, does not heal, but widens more and more, and becomes the site of fungous protrusion. 8. Osteosarcoma does not invade the neighboring tissues; but pushes them aside by its expansion, and abides within the bone in which it was first developed. In the upper jaw, for

Fig. 150.

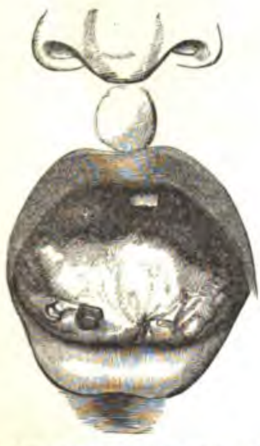


Fig. 151.

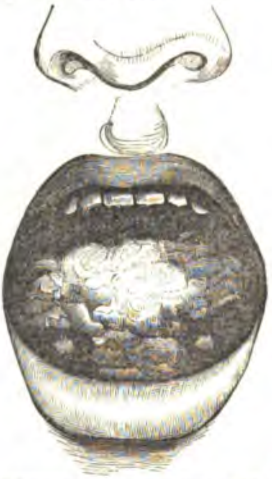
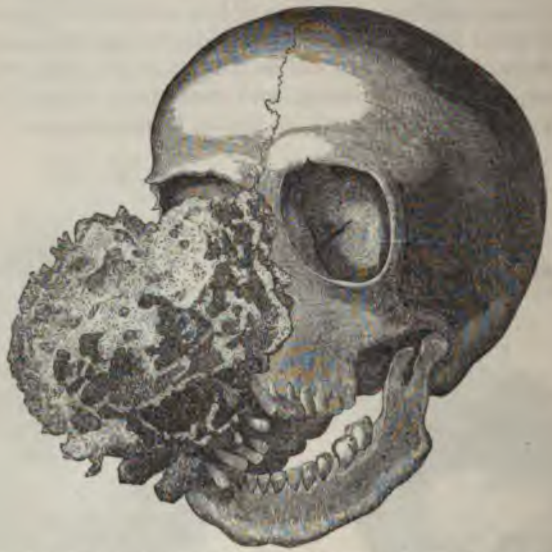


Fig. 150. Osteosarcoma of lower jaw. Hard, smooth, non-ulcerating. Slow in growth. Fig. 151. Osteocephaloma; contrasted with the preceding. Soft, fungous, ulcerous, rapidly enlarging, and involving all textures.—LISTON.

example, it remains limited to the expanded confines of the antrum. And, at those parts where the bony and even membranous parietes are deficient, there is no ulceration followed by fungous protrusion; but only a moderate increase of growth, in a lobulated form, with or without a rawness of the surface. Osteocephaloma, on the other hand, pushes no texture much aside, but early involves all; the antrum is soon passed beyond; and the base of the cranium is affected, even before much appearance has been made externally. Wherever deficiency of the investing texture occurs, ulceration and fungous growth are sure to follow. 9. Osteosarcoma long continues in the occult condition. Breach of the surface, when it does occur, does not extend rapidly, and evinces no malignancy of character. The discharge is purulent, or puriform; not profuse. There is no tendency to hemorrhage, unless by accidental injury; and then it is slight, and easily restrained by pressure. Osteocephaloma soon passes from the occult to the open state. The ulcer spreads, and is obviously the seat of malignancy. Discharge is profuse, fetid, and bloody. Hemorrhage is not unlikely; of spontaneous origin, and little amenable to control. 10. Osteosarcoma does not spread; either by contiguity in the tissues, or remotely by the lymphatics. Osteocephaloma does both; at an early period, the lymphatics are manifestly and hopelessly involved.

Fig. 152.



Large Osteosarcoma of upper jaw; macerated, showing the osseous stroma. Still limited to the superior maxilla, in which it originated.—HOWSHIP.

Such are the striking differences between the two tumors. The distinction is equally great in the treatment applicable to each. If the tumor be an osteocephaloma, operation is warrantable only at a very early period; when there is a certainty that the whole of the affected parts, and something more, can be wholly removed; and when there is good reason to hope that the constitution is not much and irreparably involved. An osteosarcoma, on the other hand, admits of operation till a late period. Its extirpation may be fearlessly attempted, with a good hope of success, even after the tumor has attained an enormous bulk; and experience has fully shown, that though the operation may be bloody and severe, yet it seldom terminates but in a fortunate issue. In a case closely resembling (Fig. 152), no single bad symptoms marred the cure; which was permanent.

In regard to prognosis also, the tumors widely differ. After removal of an osteocephaloma, even under favorable circumstances, we can never be certain of immunity from return. When a genuine osteosarcoma, on the contrary, has been taken away, the mind may be at ease. For return is very improbable; even when the operation has been performed at an advanced age of both tumor and patient.

Osteocarcinoma

Is comparatively rare. When it does occur, it is usually as a secondary symptom of malignant cachexy; the primary indication of which has been the formation of carcinoma in the soft parts—as in the mamma. The formation of such secondary growth, as formerly observed, may be excited by the occurrence of fracture (p. 285). Or the order of events may be reversed; the tumor gradually expanding and attenuating the bone, by its growth from within; and the bone, thus changed, snapping across under some slight exertion. Under such circumstances, all hope of cure is vain—even by amputation.

Osteocancer, a malignant ulceration of bone, is not uncommon. Usually of secondary origin also; the invasion having come from the soft parts. A malignant ulcer of the scalp, for example, not unfrequently involves the subjacent skull in a hopeless loss of substance. A similar occurrence, in either of the extremities, would warrant amputation; unless lymphatic tumor, or other indication of an irrevocably involved system, should contraindicate all active interference.

Osteomelanosis.

This disease, too, is usually secondary; the melanotic matter infiltrated, or in distinct patches. Sometimes separate and distinct; more frequently, as in soft parts, associated with medullary formation. There is no remedy but by amputation; and the cases are few in which that operation will be deemed expedient (p. 295).

Vascular Tumors of Bone.

Bone may be variously affected by a morbid condition of the blood and bloodvessels. 1. *Osteoaneurism.*—A kind of false aneurism may form in the cancellous texture; an artery giving way, and blood accumulating so as to distend the laminated portion into the form of a tumor, of greater or less magnitude. This may be the result of external injury, by rupture of the arterial coats; or it may form spontaneously, by arterial ulceration. It has occurred in the head of the tibia, the condyles of the femur, the scapula, and the clavicle. Cure is to be attempted, by tying the principal arterial trunk leading to the part; at the same time applying uniform sustained compression of the tumor. Should this fail, or be deemed either impracticable or unadvisable, removal of the affected bone, or portion of bone, by amputation, will be expedient; if the part be so situated as to admit of this operation. For were the disease left to itself, the open condition would, sooner or later, be attained; and death by hemorrhage ensue. A remarkable example of this disease occurred to Mr. Liston, and is related in his Elements of Surgery, p. 170.

2. Erectile tissue may become developed in the cancellous texture, expanding the laminated portion of the bone, so as to form, as it were, its outer case. The symptoms are necessarily obscure. Fortunately, the occurrence is rare. Deligation is plainly inapplicable. Amputation must be had recourse to.

3. Either of the preceding varieties may be conjoined with medullary deposit. In such circumstances, early and free removal, by the knife, is plainly and urgently indicated; but with an unfavorable prognosis, as to the probability of return.

Pulsating Tumors of Bone.

Certain enlargements of bone are observed to be endowed with pulsation; this varying from a mere thrill, to the strong impulse of an aneurism. The cause is various. It may be from the inherent structure of the tumor, as in erectile tumor of bone, and osteoaneurism. Or the nutrient arteries of the bone may be preternaturally enlarged. Or it may be in consequence of an osteocephaloma overlaying a large artery, or being permeated by one, and so receiving its impulse; thus simulating the aneurismal state, as tumors of the soft parts do in like circumstances. Sometimes, nay often, bruit accompanies pulsation. And, in consequence, accurate diagnosis may be rendered very difficult.

Entozoa in Bone.

Hydatids have not unfrequently formed in the cancellous texture of bone. Under their accumulation the walls of the bone expand, so as to form a tumor of greater or less size, and of varied form. And then, attenuation and deficiency of the parietes taking place, the hydatids may escape into the superimposed soft tissues; causing suppuration there, and subsequent discharge of themselves along with the purulent secretion. In a flat bone, such as the cranium, removal of the disease may thus be obtained; by the aid of surgical interference. In the long bones, the occurrence is likely to lead to fracture, under very inauspicious circumstances.

Treatment, accordingly, will vary according to the extent and site of the disease. The bone may be exposed by incision, the hydatids and altered osseous tissue may be scooped and gouged away, and the parts may afterwards granulate and heal kindly. Or it may be necessary at

Petit, des Maladies des Os, Paris, 1741; Morand, Hist. de la Maladie Singulière, &c. Ramollissement Général des Os (Madame Supiot's case), Paris, 1752; Troja, de Novorum Ossium Regeneratione Experimenta, 1775; Koehler, Experimenta Circa Regenerationem Ossium, Gott. 1786; Weidmann de Necrosi Ossium, Francof. 1793; Russell on Necrosis, Edin. 1794; Boyer, Leçons sur les Maladies des Os, Paris, 1803, and translated, London, 1807; Howship, in Med. Chir. Transactions, vols. vi, vii, viii, and x, Lond. 1815; J. Wilson, Lectures on the Structure and Physiology of the parts composing the Skeleton, and on the Diseases of the Bones and Joints, Lond. 1820; Scarpa, de Pathologia Ossium, Ticini, 1827; Sanson, de la Carie et de la Necrose, Paris, 1833; Meischer, de Inflammatione Ossium, Berol. 1836; Goodsir, Anatomical and Pathological Observations, Edin. 1845, and Monthly Journal, February 1850; V. Bibra und Geist, die Krankheiten der Arbeiter in den Phosphorzundholzfabriken, Erlangen, 1847; Syme, Contributions to the Pathology and Practice of Surgery, 1848; Stanley on Diseases of Bone, Lond. 1849. See also the classified bibliography of this subject in Otto's Pathological Anatomy, translated by South.

CHAPTER XIII.

DISEASES OF THE JOINTS.

FORMERLY, all the graver examples of disease in joints were included under one common designation, "*White swelling;*" a custom, scarcely convenient, which led to much confusion and inaccuracy as to the nature of the affections, and to at least uncertainty in their treatment. But, thanks to the labors of modern surgeons—among whom, in this department, the name of Sir Benjamin Brodie stands pre-eminent—much of this confusion and uncertainty have been dispelled; and each disease, set forth in its proper site and character, may have its appropriate remedy or system of treatment assigned. As can be readily understood, however, such discrimination can only be practised while the disease is yet comparatively recent; for, after a time, the morbid process, in whatever texture it may have originally dwelt, involves the whole articulating apparatus in one chaotic mass of disease. It is at the beginning of the disease, that treatment is most likely to prove successful; and fortunately, it is at the same period that we enjoy a facility of discrimination and accuracy of diagnosis.

We shall consider, in succession, the results of disease in the different component textures of the joints: 1. In the Synovial Membrane; 2. In the cartilage; 3. In the Bones.

SYNOVITIS.

By this term is meant the inflammatory process occurring in synovial membrane; a tissue in many respects resembling the serous, both in health and disease. The affection may be either acute or chronic.

Acute Synovitis.

The inflammatory process tends to spread from one part over the whole membrane, to assume an intense character, to be accompanied with much effusion, and to result in serious change of structure. At first the membrane becomes congested, turgid, and shows an apparent increase of vascularity; the natural secretion is poured out in increased quantity, and of a more aqueous character than in health. This necessarily causes general swelling of the part; which forms almost synchronously with the first painful indication of the morbid process, and is diagnostic of the affection. Then the membrane begins to change in structure; by interstitial exudation. It becomes thickened, soft, red, almost pulpy; and loses its translucency, as well as the smooth glistening appearance of its internal surface. At this time, effusion ceases to be chiefly serous, and contains more or less of fibrin, usually floating about in detached flakes; and also the fibrin is found adherent to the surface of the membrane, as well as deposited in its parenchyma. It is at this stage of the process adhesion may occur, between two opposing portions of the membrane; causing obliteration of some part of the joint's cavity. But this result is of comparatively rare occurrence; probably for two reasons. First, the process usually tends rapidly onwards, and soon overpasses the opportunity for plastic formations; quickly arriving at the suppurative and ulcerative stage. Second, because the presence of much fluid in the joint is plainly inimical to adhesion; the surfaces being separated by the distension.

Subsequently, as the suppurative crisis is approached, and also after it has occurred, change of structure increases. The membrane, besides being thickened and changed in itself, becomes incorporated with the plastic exudation which has adhered to its free surface; and which, by partial organization, has assumed a membranous appearance and function. This layer of false membrane, as it is termed, is in all respects analogous to the pyogenic membrane of ordinary acute abscess; and by the exercise of its newly assumed function, purulent secretion is continued in greater or less quantity. At first it mingles with the serum already within the synovial pouch; and the contents are seropurulent. But soon the serous character is altogether merged in the purulent; the thinner portion of the fluid having probably been absorbed. Throughout the whole period, the superimposed soft parts have been sympathizing closely; themselves involved in a minor grade of disease, and consequently becoming swollen and infiltrated thereby.

The symptoms which accompany these results of the inflammatory process are sufficiently distinct. Pain is early and severe. It is constant; and, gradually increasing in severity, ultimately becomes intense. There is swelling; also gradually on the increase, sometimes becoming great; and, as already stated, its accession is synchronous with that of pain. The swelling is not altogether uniform; but is much more so than in the chronic form of the affection. The joint naturally becomes most prominent at those points where there is least resistance; in the knee-joint, for example, bulging is chiefly lateral, and beneath the tendon of the quadriceps muscle. But then such peculiarities of tumor become very much obscured and masked, by general œdematous swelling of the superficial parts. The skin is red, tense, hot, and sensitive. The pain is general; pervading the whole part, but greatest in the interior; much aggravated by pressure, and altogether intolerant of the slightest motion.

A position is assumed, naturally, in which the parts affected are most relaxed, and pressure removed from the opposed surfaces. And, besides, as the joint fills with its fluid contents, flexion necessarily occurs from a physical cause.[1] Relief is felt from this posture; and it is not only assumed but maintained involuntarily. Also, the muscles in the neighborhood are found somewhat involved. Their tonicity is increased; as evinced by firm solidity of the muscular fibre, and rigidity of the tendon. For example, when the knee is affected, we find it in a state of semi-flexion, with the ham-strings tense and hard as cords. The muscles are liable to spasm also; whereby involuntary startings of the limb occur, especially during the short and uncertain periods of disturbed sleep; and by the jerking motion thereby occasioned, all the symptoms are much aggravated. The constitution labors under inflammatory fever, of a grave kind; which increases with the progress of the local disorder.

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[1] British and Foreign Review, No. xxxvi. p. 355.

On suppuration having occurred, there is marked aggravation of all the symptoms, both constitutional and local; and a succession of rigors usually ushers in the exacerbation. Fever rises higher, and the system is proportionally more oppressed; swelling is larger and more tense; the pain, heat, and feeling of tightness are increased, accompanied with a deep-seated throbbing; and each pulse seems still further to augment the pain. The superficial swelling becomes of a more urgent character; being the result, now, of a higher grade of disease. Fluctuation within the joint also changes its type; and affords to the experienced touch a tolerably certain indication of pus, not of serum. At one or more parts, the swelling begins to point; the matter now approaching the surface, by ulceration and absorption of the intervening textures. Ultimately the integument, at the prominent points, either gives way or is opened artificially; the matter is discharged; and the joint's cavity is free to the external air. For a short time, immediately subsequent to evacuation, the more urgent symptoms subside; from the relief of tension. But, very soon, a second aggravation generally ensues; even greater than that which followed the first formation of matter. A fresh inflammation, as it were, seizes on the parietes of the abscess; and the destructive process rages anew, accompanied by violent constitutional disturbance, perhaps now of the irritative rather than of the inflammatory type of fever. This, in its turn, is not unlikely to give way to hectic; the whole joint having become a prey to the worst results of inflammation, and the system beginning to sink beneath its burden.

Such is the nature of acute synovitis; when its whole course is run. But it is to be understood that, at any period of the process, the disease may cease to advance and begin to subside; spontaneously, or from treatment; and that the symptoms will vary accordingly.

The disease may originate without any apparent *Cause.* More frequently, it is the result of injury; as bruise, or wound. In the latter case, unless the union be by simple adhesion, synovitis is inevitable. For, it being necessary to granulation that the wound should previously inflame, a portion of the synovial capsule inevitably partakes in that process; and, as already stated, it is a peculiarity of that tissue that inflammation, attacking a part, quickly spreads over the whole. Whence a plain and practical inference is to be drawn; how, in the treatment of wounds of joints, it is of the greatest moment to subdue or avert inflammation, and insure simple adhesion. Rheumatism is a frequent predisposing cause of synovitis; the local disease being modified by the specific diathesis. And, during the prevalence of this diathesis, a very slight exciting cause suffices; or even this latter may be altogether dispensed with. Exposure to cold often induces the affection; even in persons previously of the most robust health; but most readily, of course, in those having a rheumatic tendency. And mercury, among its many evil results, often remote, is an undoubted, frequent, and prolific parent of some of the worst forms of synovitis; at least, if not both predisposing and exciting cause, it is certainly the former.

The joints most liable to be attacked, are those of the extremities; most exposed to external violence, and to atmospheric vicissitude; the knee, elbow, wrist, and ankle. On the whole, the first is the most frequent sufferer.

Treatment.—Treatment is early, active, and severely antiphlogistic. Blood is taken away copiously from the near vicinity of the inflaming part; by leeches or by cupping. And, unless contraindicated by other circumstances than those connected with the disease, blood may be also taken from the system, by venesection; it being obviously of the utmost importance to check the process at its outset; or, at all events, to bring it down to a slower rate of progress, and to a minor grade of intensity. The tissue affected is endowed with both importance of function and delicacy of structure. After bleeding, therefore, the exhibition of calomel and opium is advisable; as being most calculated, by its systemic influence, to save structure, and consequently retain function (p. 150). Should circumstances render mercurialization inexpedient, or at least hazardous, full doses of the tartrate of antimony may be substituted. When the rheumatic diathesis is apparent, colchicum will be preferable to either; pushed, in full doses, till its physiological effect has been at least threatened, if not established.

The limb is encouraged to maintain the relaxed posture, voluntarily assumed; and immunity from motion is anxiously secured, by gentle deligation of the part to soft pillows, skilfully and carefully arranged. Purgatives are inexpedient; as opposed to immunity from motion. Should tendency to spasm prove troublesome, opiates are advisable; given in combination with camphor and hyoscyamus. Fomentation is applied to the part; regimen is most strictly antiphlogistic; and, in short, all the ordinary details of antiphlogistic treatment are rigidly enforced.

In the great majority of cases, early seen and judiciously treated, the disease is arrested in its progress, ere the suppurative crisis has been attained. Then, as ordinarily happens in acute serous effusion, the work of resolution slowly advances, almost spontaneously; aid from treatment consisting merely in continued rest of the part, occasional fomentation, and maintenance of the spare regimen. Absorption is soon busy in clearing away the results, and, in most cases, is equal to the efficient completion of its task. But should it begin to flag, then it may be assisted from without; by gentle friction, pressure, stimulating plasters or inunction, or the slightest forms of counter-irritation; these, however, being always adopted cautiously, and as if with hesitation; lest, by their premature use, the embers of a not yet extinct disease might again be lighted into a flame.

When the inflammatory process has subsided, and its results also have been removed, motion is to be gradually restored; at first, passive and gentle, always desisted from when pain is induced; and invariably both commenced and conducted with the same precaution, as in stimulation of absorption. Many a limb has been lost—for many a joint has suppurated—in consequence of reaccession of acute disease, from imprudent resumption of motion. Some, while they abstain from motion, yet forcibly alter the position of the joint during acute progress; on the ground that thus all awkwardness and deformity are more likely to be avoided. It is, doubtless, an object of very great importance, that the part's function should ultimately be restored; that the limb should not be permanently bent, and the joint not permanently stiff; but an over anxiety to fulfil this indication will lead us to straighten the limb, and move the articulation, too much and too soon. And, surely, the safer side on which to err, is to run some hazard of trouble by threatened anchylosis; none whatever of reinduced disease, and probable disorganization of the part thereby. It seems wiser to humor the natural position of the limb, during acute progress; and, when this has passed, to restore what is normal gradually and with caution.

During the progress of disease immunity from motion is essential; but, when disease has passed away, resumption of motion is equally imperative. For, even independently of other considerations, it is to be borne in mind that long-continued immobility of a joint is, of itself, sufficient to cause serious structural change; effusion of blood or serum into its cavity, fibrinous change of the synovial membrane, disease of the cartilages, and anchylosis.[1]

During the whole period of cure, up to the time when motion is begun to be systematically restored, all movement in the joint is to be most studiously avoided. During the acute stage, the part is intolerant of bandages and splints; then we have to trust to pillows, and gentle deligation thereto. But so soon as the acute stage has passed away, sufficiently to permit the application of splints, these are forthwith had recourse to; being by far the most efficient means of fulfilling the all-important indication in view. The preferable kind are those of thick leather, softened by immersion in hot water; applied when pliable—usually one on either aspect of the limb; retained, by bandaging, for a few hours, till they harden into a case closely adapted to the undulating surface of the part; then removed, and lined by some soft substance, such as tow, wadding, or chamois leather; reapplied with moderate tightness, and constantly retained.

When, unfortunately, our efforts to arrest the disease have failed, and suppuration has occurred—the interior of the joint being, in truth, converted into an acute abscess—the general rules of surgery are not to be departed from; an early and free incision should be practised. This, however, can only be had recourse to, when the symptoms are so very distinct as to leave not the slightest doubt of suppuration having occurred. To plunge a bistoury into the cavity of a joint, filled with serous or sero-purulent fluid, would be a most unwarrantable procedure; rendering disorganization certain, where otherwise all might have been saved; such fluids, and the change of structure which attend on them, being perfectly amenable to absorption. When there is any doubt, therefore, as to the nature of the contents, we withhold the knife, for a time. If they are purulent, the natural process of pointing will soon disclose the real state of matters; and then incision is unhesitatingly performed. Should the nature of the contents continue doubtful, the case having assumed a chronic form, puncture may be made by a fine grooved needle; subsequently applying exhaustion by means of a cupping-glass, if need be, in order to exhibit a portion of the fluid from within.

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[1] Teissier. British and Foreign Review, No. xli, p. 141.

After incision, accession of additional inflammation is inevitable; and has to be guarded against accordingly. The maintenance of rest, with other local management, is if possible more assiduous than before; and temporary resumption of general antiphlogistics will probably be expedient. Afterwards, our expectation is that the cavity will gradually contract and close; as do other acute abscesses. But, on account of the peculiar nature of the parts implicated, it is not improbable that such hopes may be disappointed.

Purulent formations not unfrequently form in the larger joints, in the latter stage of severe phlebitis. Such cases, however, are altogether different from ordinary abscess. They are not the disease, but only a symptom of one infinitely more formidable; under which latter, the system has rapidly given way, and is altogether irrecoverable (p. 205). The complication, by articular abscess, does not cause, but probably accelerates dissolution—already very near. There is seldom time or opportunity afforded for treatment of the local malady; even should that be deemed expedient. But if there should, general principles are still to be enforced; a free and dependent incision is practised.

Chronic Synovitis.

This may be either simple in its nature; or connected with and marked by the scrofulous cachexy.

1. *Simple Chronic Synovitis.*—It may be original or secondary. The inflammatory process may have been chronic from the first; or originally acute, subsequently assuming the chronic form. The pain, heat, &c., are comparatively slight. Swelling is the prominent symptom. And now the peculiarities of bulging, dependent on the structure of the joint, come to be distinctly seen—a circumstance diagnostic between the chronic and acute forms of synovitis (p. 431). For the superimposed soft parts sympathize but little in the perverted vascular function, and consequently cause little or no obscuration of the synovial tumor. The membrane is thickened, dull in hue, increased in vascularity; and gradually changes its smooth internal aspect into a soft, pulpy, or villous surface. The cavity contains more or less of a serous fluid; either pure, or mingled with a small proportion of puriform secretion. This has accumulated slowly; the parts have gradually accommodated themselves to its presence; and the process of distension is consequently attended with but little uneasiness.

Sometimes the process of accumulation is peculiarly indolent and painless; and yet tolerably rapid in its rise. The superficial soft parts are wholly uninvolved; the whole disease seeming to be the product of a suddenly occurring passive congestion of the synovial membrane, and limited to that texture. The fluid is entirely serous; and the form of the swelling is very decidedly influenced by the natural configuration of the joint. This condition is termed *Hydrops Articuli.* The knee is its most frequent seat. It is most apt to occur at or beyond adult age; and in those who have suffered from mercurial exhibition.

Chronic synovitis, though not in itself important, or urgent in its nature, is nevertheless fraught with danger by continuance. For, at any time, a slight exciting cause will suffice for the induction of acute inflammatory accession. Even supposing that this do not occur, structure is certain ultimately to be most seriously changed, by persistence of the present affection, chronic though it be; and that not only in the texture originally involved, but in others to which the disease may gradually extend—the cartilages, and even the bones. In another point of view also, the affection is important; when we remember how much more difficult of satisfactory removal, are the results of chronic than those of acute effusion (p. 172).

The prominent symptom, as already said, is the unequal, fluctuating swelling. There are also dull pain or uneasiness, some heat, and great limitation of motion; the joint is more or less flexed, and the tendons of the flexor muscles gradually assume a rigid condition. The limb, by confinement, wastes; and its muscles become altered in structure as well as in bulk.

When the disease is extending to other tissues, and formidable though chronic change of structure is in progress, the swelling often loses its lax fluctuating character. The thinner portion of the synovial contents is probably being absorbed; fibrinous deposit is taking place both within and without the synovial cavity, and in the substance of the textures themselves. The swelling, consequently, becomes more solid and less fluctuating; the joint is more painful, and more abridged in motion; and constitutional sympathy, before perhaps slight, now becomes considerable—tending towards the hectic type.

Chronic synovitis is seldom the result of external violence. More commonly, it follows exposure to cold; or it may be attributed by the patient to some slight twist or strain; and it most frequently occurs in those who have suffered by the venereal poison, by the mercurial, or by both. Rheumatism, too, is a fertile inducing cause.

Treatment.—Moderate local depletion, by leeching, is at first employed, with rest; not so much on account of a remedial effect expected from itself, but rather to render subsequent use of counter-irritation, on which the main hope of cure has to rest, safe and expedient. Were this to be had recourse to at once, stimulation and increase of the chronic inflammatory process might result; instead of its arrest and subsidence. Preliminary gentle antiphlogistics stop the progress of the affection; counter-irritation gradually subdues it, and effects its final extinction; at the same time favoring disappearance of abnormal deposits, both solid and fluid. The counter-irritants may be varied, according to circumstances: blisters, in succession; croton oil embrocation; tartar emetic ointment or solution; or an ointment of nitrate of silver, strong enough to produce a pustular effect by inunction—are some of the most common and suitable forms.

When the inflammatory process has fairly ceased, and all is quiet, then the attention may be mainly directed to discussion, or stimulation of absorption. With this view, various discutient plasters may be applied; as the gum plaster, or the mercurial, or equal parts of both. Or pressure may be used; either by simple bandaging, or by combination of this with plaster. The iodide of potassium may be used in the form of ointment, as well as given internally; or a strong solution of iodine, either aqueous or alcoholic, may be pencilled on the surface. But, still, let the effects of these remedies be carefully watched; lest, unfortunately, over-stimulation be induced. And throughout the whole treatment, let the paramount indication be—rigid maintenance of absolute rest in the affected part, by splints; at first lightly applied, so as merely to prevent motion; afterwards with tightness, in order, by their pressure, to assist in the favoring of absorption. In due time, by passive motion, cautiously increased, the joint's function is restored.

Constitutional management is not to be disregarded. Invariably, more or less disorder will be found in the system; and rectification of that is essential to due advancement of the cure. If any peculiar cachexy exist, as is not unlikely, it must be met by the suitable remedies; obstinate and lurking venereal taint, by an alterative and cautious mercurial course; mercurial taint—the more frequent of the two, either single or combined with the preceding—by sarsaparilla, or the iodide of potassium; rheumatic diathesis, by colchicum, &c.

In hydrops articuli, the most trustworthy remedy is iodine; used both externally and internally. Should it fail, mercury, unless otherwise contraindicated, may be cautiously tried in a similar way; externally, in the form of ointment or plaster; internally, as an alterative course, mildly and prudently, and as if reluctantly given. Or the tartrate of antimony may be administered internally; pushed, in almost as full and as frequent doses as for pneumonia. This, however, is a harsh remedy; and not to be employed till others, more simple and more usual, have been tried and failed. Locally, acupuncture, with subsequent application of the exhausted cupping-glass, has been tried; but the result has proved unsatisfactory, as to cure; and, besides, the practice is not free from the risk of lighting up acute inflammation. And a similar objection will apply to simple acupuncture, practised with the view of permitting the serum gradually to escape into the superficial areolar tissue; so converting the dropsy into diffuse œdema. Lately, it has been proposed to treat the part as if it were a hydrocele; to draw off the serum by tapping, and subsequently to inject a solution of iodine. But the practice seems, at first sight, so very likely to produce over-stimulation of the susceptible synovial tissue, that, until ample experience shall have declared it a safe procedure, we shall hold such tamperings with the larger articulations—the knee, be it remembered, is the most frequent seat of the disease—to be at least inexpedient.

2. *Scrofulous Chronic Synovitis.*—This affection is accompanied with marked indications of the strumous cachexy; throughout its whole course, as well as previously to accession. The membrane slowly degenerates into a gelatinous pulpy substance, soft, and of a whitish or light gray color; at first with merely an exaggeration of the ordinary secretion, slightly perverted in character—thicker and more opaque. But suppuration is not unlikely to follow, probably occasioned by acute

inflammatory accession; or, it may be, merely in accordance with the onward progress of the original disease. From whatever cause induced, the occurrence is quickly followed, as usual, by great aggravation of the symptoms, both general and local, and speedy disorganization of both cartilage and bone.

The symptoms differ from those of ordinary synovitis. The patients are usually adolescents; and evince, more or less strongly, the scrofulous cachexy. A slight injury, as a blow, strain, or twist, may or may not have been sustained by the part. The joint slowly swells, and has its motion more and more impaired; but little or no pain is experienced. The swelling is soft, doughy, somewhat elastic, but totally devoid of anything like true fluctuation; the integuments are pale, and scarcely tense; and even free pressure and manipulation are comparatively well borne. In this indolent condition, the joint may continue for months. But, failing gradual cure, or approach thereto, suppuration usually supervenes; followed and characterized by the usual aggravation of symptoms, both local and general.

During the progress of this disease—and, indeed, the observation may be extended to almost all serious and chronic structural change of joints—the whole limb undergoes an atrophy; hard textures as well as soft. The bones become more slender in their shafts, and of less density (p. 370); the adipose tissue disappears by absorption; the muscles grow flabby, pale, small, and weak; and in the lower part of the limb, passive congestion and œdema are not unfrequent.[1]

It may be here stated, also, that in many examples of diseased joint, in whatever texture morbid change may have originated, the advanced stage is often complicated by enlargement of the lymphatic glands; sometimes indolent, sometimes active and prone to suppuration—occurring in the axilla, from diseased elbow, for example; in the groin, from diseased hip or knee. The complication is a serious one; and ought always to be taken into account, in both treatment and prognosis.[1]

Treatment.—In the early stage, local treatment is the same as for simple chronic synovitis; rest and counter-irritation, the latter preceded by very moderate depletion. Constitutionally, the ordinary remedies are to be employed, whereby the system's taint may be most hopefully opposed; and this anti-strumous treatment must be maintained, unweariedly, throughout. When the indolent condition has become thoroughly declared, pressure and confinement from motion—so as at once to arouse absorption of the redundancies, and to permit its advance without interruption—constitute the principal remedial means.

Rest and pressure, indeed, are powerful agents of cure, in all chronic affections of joints, however originated; whether occurring in their hard or soft tissues; but most hopeful in the latter case, as can readily be imagined. And there is every reason to believe, that to the more skilful, as well as more frequent use of these remedial means, the marked improvement in the treatment of diseased joints, in modern times, is mainly to be attributed. Many an articulation is now saved, which formerly would have been unhesitatingly doomed to amputation.

Much credit is due to Mr. Scott, for having directed attention to the importance of rest and pressure; combined with moderate irritation of the surface. And a modification of what is ordinarily termed "Scott's dressing," will be found a most valuable remedy for all chronic affections of joints in the truly indolent stage; more especially for those wherein the disease has not only originated in the synovial apparatus, but is still limited to that tissue. The limb having been uniformly supported by a bandage, from its extremity up to the affected joint, the surface of the swelling is covered by strips of lint, spread with some gently stimulating ointment—soap cerate with camphor for example, or that with a greater or less proportion of the unguentum hydrargyri. The whole articulation is then surrounded by long bands of adhesive plaster; drawn with moderate and uniform tightness, so as to support and firmly yet uniformly compress the parts, without producing absolute pain or uneasiness. Above all, splints are applied, to secure total immunity of motion; and they may be of leather, of pasteboard, or of wood—the first usually the most suitable. When this dressing has become loose, from subsidence of the swelling—as usually happens in a few days, when first employed, progress thereafter becoming more gradual—it is reapplied as often as may be necessary. But should fresh excitement occur in the joint, from any accidental cause, this system of dressing must be discontinued until such excitement has been subdued by the usual means; and when pressure is resumed, it should at first be very moderate. Such acute reaccessions are least likely to occur, in the truly synovial affections.

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[1] British and Foreign Review, No. xliii, p. 75.

During treatment, the limb must be kept or gradually brought into the most advantageous position for future usefulness; particularly if from the nature, duration, and extent of the disease, there is reason to fear ultimate impairment of the joint's motion. Thus, by steady extension with splints, the knee-joint may be brought into nearly a straight position, so that it shall be serviceable in progression; and the elbow may be bent, to form a right angle with the humerus, so as to be convenient for prehension. By prudent yet persevering friction, and occasional passive motion, these desirable changes may be greatly facilitated. But all such alterations of stiffened limbs must be proceeded with very cautiously; otherwise, they may occasion undue excitement, and consequent renewal of the disease.

3. *Brown fibro-gelatinous Degeneration of the Synovial Membrane.*—The joint most frequently attacked by this formidable disease is the knee; and the usual patient is the adult female. The synovial membrane slowly and insidiously degenerates into a pulpy-looking substance, differing from the ordinary result of scrofulous degeneration, in being of darker hue, and of greater thickness and extent. It is also of greater density, and intersected by many firm, fibrous bands, somewhat after the manner of carcinoma. It is not asserted that the two diseases are identical; but they certainly do resemble each other, as to the fibrous constituents, in the apparent section. And though the disease now in question is possibly no more than the last stage of a chronic inflammatory or scrofulous disease, yet most certainly it is as little amenable to remedial treatment as if it were truly malignant.

At first, the external indications are similar to those of simple gelatinous degeneration; a gradual, soft, comparatively painless tumor of the joint, unaccompanied by superficial excitement. Yet the swelling is more diffuse, and less prominent; as if indicating that the disease had more securely and deeply fastened on the whole extent of the joint. It is more decidedly elastic; often simulating true fluctuation very closely. It is of a uniform character; and has no peculiar bulgings, dependent on the natural form of the joint. The uneasy sensations are greater, and obviously more on the increase; of a deep gnawing kind, gradually augmenting into smart lancinating pain. There is an obvious concomitant cachexy; a sallowness of hue, loss of strength, flesh, and spirits, and ultimately gradual sinking in the form of a modified hectic.

The local disease seldom, if ever, assumes the quiet indolent form, so frequent in the simple synovial degeneration. Only at its commencement, is it slow and latent. Once fairly established, it advances steadily; and sometimes with rapidity. Ultimatel[illegible] he joint is wholly destroyed. Cartilages, bones, ligamentous apparatus, are all quickly involved in ulcerative destruction. The joint opens, probably at several points; urgent hectic is lighted up; and amputation is imperiously demanded. Or the patient may sink, without any opportunity having occurred for the trial of that doubtful remedy.

In some instances this peculiar degeneration is accompanied by malignant disease of the bones. Then there is no acute crisis, followed by opening of the joint and its rapid disorganization. But there is a steady increase of both the general and local symptoms. The face gets more and more thin and cadaverous, the frame wasted, and the vital power sunk. The tumor continues steadily to advance; and ultimately it is observed that the rate of growth has plainly increased. The surface becomes tense, smooth, polished, and traversed by large veins; pain is more acute, constant, and lancinating; elasticity is more prominently its characteristic than ever; fluctuation may be suspected, and a plunge made by the trocar or knife—but nothing escapes, save blood, and that copiously. This latter, however, may be considered only an occasional result; the former—disorganization by the ordinary inflammatory products—is probably the more frequent.

Treatment.—This may be comprised in very few words. In the early stage alone, can we hope for an altogether successful issue; and this is to be sought for by the ordinary means; rest, and attention to the general system. Even then, cure is far from certain; nay, it will prove the exception rather than the general rule. After the onward progress has been fairly declared, the sooner amputation is performed the better; a severe measure, doubtless, but fully warranted by experience.

The Fimbriated Synovial Membrane.

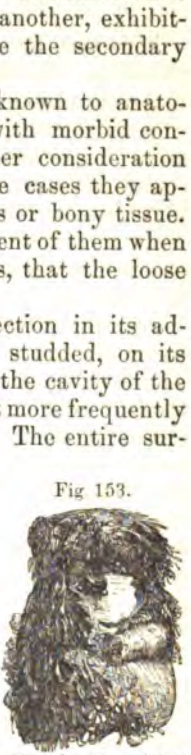
The affection now to be described does not always require surgical interference; indeed, in its slighter forms, it may be considered as a
of the normal condition. According to Mr. Rainey, those
ca, or bursæ, least exposed to pressure, are provided
ition of the synovial apparatus. Loops of capil-
s of complexity, project into the joint, covered
isposed in the form of "sacculi" or villi. "From
capillaries, numerous other sacculi, into which

no capillaries enter, proceed; these are of various forms and sizes, but generally they are attached to the primitive sacculus by an extremely long and slender filament of fibrous tissue, resembling the petiole of a leaf, the secondary sacculus resembling its expansion. Sometimes there are several series of these sacculi attached one series to another, exhibiting an arborescent appearance; but in every instance the secondary sacculi are extra-vascular."[1]

These fringes of synovial membrane, though long known to anatomists, have received too little attention in connection with morbid conditions. It is nearly certain that the disease now under consideration consists in the mere hypertrophy of these; and in some cases they appear to become the seat of deposits of fibro-cartilaginous or bony tissue. According to Mr. Rainey (*loc. cit.*), it is by the detachment of them when thus transformed, from rupture of their narrow pedicles, that the loose bodies in joints, hereafter to be noticed, are produced.

The following is Mr. Liston's description of this affection in its advanced condition. "The synovial membrane may be studded, on its inner aspect, with pendulous substances projecting into the cavity of the joint; sometimes of almost cartilaginous consistence, but more frequently of a fatty appearance (*Lipoma arborescens* of Müller). The entire surface of the membrane is occasionally covered with these bodies, which are of a white or yellowish color, and very variable in size and shape; the smallest presenting the form of villi not much larger than those of the jejunum, the largest having somewhat the magnitude and appearance of the appendices epiploicæ of the large intestine, while many of an intermediate size approach in appearance to a lemon seed. In some instances the membrane is only partially pervaded by them; and sometimes, they are arranged like a fringe around the edge of the articulation. They are generally very smooth on the surface; which appears to be perfectly continuous, if not identical, with the synovial membrane. Their attachment is sometimes broad, sometimes very narrow and pedunculated, often merely filamentous; so that a little further thinning of the part, or slight force acting on the body, would remove it from the capsule, and throw it loose into the cavity of the articulation. The disease has been most frequently seen in the knee, and sometimes in the elbow.

Fig 153.



Fimbriated knee-joint; the surface of the patella is the only part unoccupied.

"The affection is obscure in its nature, and slow in its progress; the joint is the seat of pain after and during exercise, probably from the abnormal processes interfering with motion of the articular surfaces. As the disease advances, the joint becomes swelled and elastic; unattended, generally, by ulceration of the tissues within or around it. In examining the part, when the articular surfaces are moved on each other, it will be found that their motion is more or less interfered with; and considerable irregularity in their action may be felt, by the hand placed firmly on the joint during the procedure."[2]

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[1] Monthly Jour. May, 1849, p. 747; Quain and Sharpey's Anat. Introd. p. cclxxiii.

[2] Liston's Elements of Surgery, p. 89.

The same treatment is required, as for ordinary synovial derangement, of the most chronic form.

The Inflammatory Process in the Exterior of Joints.

This may be of the simple and ordinary kind; and then prone to suppuration. Or it may be of an obviously rheumatic character; tending rather to chronic change of structure.

1. *Rheumatic.*—When acute, it is usually merged in a deeper and more important affection. Originating exteriorly to the joint, this sooner or later is involved; usually at a very early period; and the case may then be considered as one truly of rheumatic synovitis. But the chronic form very often is not only originally, but permanently, wholly exterior to the articulation. Or, if the latter do sympathize, it is only in a very minor grade of disease; barely sufficient to increase slightly the natural exhalation of the part—not greater sympathy than the exterior often shows in the less serious inflammatory affections of the joint. The inflammatory process is of a low grade, as well as chronic in its nature; situated in the periosteal investment of the articulating extremities of the bones, in the fibrous tissues exterior to the joint, or in both. The periosteum thickens, and becomes vascular; the corresponding surface of the bone, sympathizing fully, opens out in texture; and becomes studded by osseous nodules, sometimes shooting outwards in a spiculated form. And this new osseous formation may, by encroaching on the joint, come seriously to impair its power of motion; or even, ultimately, to cause complete stiffness, by an external true anchylosis. The ligamentous and other fibrous tissues undergo a somewhat similar change. They increase in bulk, and in vascularity; more or less plastic matter is interstitially exuded; and this, becoming organized, seriously impedes motion, and may result in more or less complete rigidity. All this is attended by ordinary rheumatic symptoms; more especially by pain, often severe, aggravated nocturnally and by atmospheric exposure or vicissitude; there is also swelling, deep-seated, hard, painful on pressure, and not unfrequently somewhat masked by superficial œdema. There is stiffness with crankiness of motion in the joint, gradually increasing; and rheumatic signs are not wanting in perhaps many other parts of the frame.

There are plainly two dangers to be dreaded, from continuance of such an affection; inflammatory accession, involving the joints in acute synovitis; and persistence of the original malady, slowly yet surely compromising the function of the part. On both counts, therefore, it is our duty to cope zealously with the malady; at an early period. Locally, by ordinary antiphlogistics; especially leeching, or cupping in the vicinity, fomentation, rest, and, if need be, counter-irritation. Consti- nally, by the exhibition of colchicum, iodide of potassium, guaiac, es, or other remedies held to be suitable opponents of the rheumatic

ple.—The inflammatory process, occurring in the parts imme- rior to a joint, unconnected with any peculiar condition of system, is usually acute; and tends towards the suppurative crisis. It may be the consequence of external injury; or it may be but a part of some more extensive disorder—as erysipelas. Or the affection may be idiopathic, and chronic in its nature; consisting first of fibrinous exudation, causing hard swelling with stiffness of the joint, dull and indolent; and, after months passsed in this type, then advancing to suppuration. However occasioned, suppuration follows the usual course; and the matter seeks the surface. If opposed in that direction—as it is certain to be, if originating among, and not exterior to the fibrous tissues—it cannot but extend both laterally and in depth; so obviously and imminently endangering the articulation. If purulent irruption take place there, it will be hard to prevent immediate invasion of such inflammation as shall result in the destruction of all the component textures, as well as in the establishment of the most violent and alarming constitutional disturbance.

Treatment, therefore, must be both early, and actively antiphlogistic; in order to arrest the inflammatory process, if possible, ere the suppurative crisis shall have been attained. When this has occurred, an incision can scarcely be made too early; free and dependent, in order to avert articular irruption. In either case, the most rigid rest is to be maintained; and constitutional symptoms are subdued by the suitable remedies.

Tophi.

These are concretions connected with the extreme articulations, more particularly of the fingers; sometimes within the joint, more frequently exterior to it—at least in the first instance; and are composed of the urate of soda. They are undoubtedly connected with and probably owe their origin to the gouty and rheumatic diathesis; especially the latter (p. 61). They may remain in an inactive state, either stationary or gradually enlarging, for a long period. Or imperfect suppuration may occur on the surface; opening the skin, and disclosing the concrete matter slowly disintegrating, and crumbling tardily away with thin puriform discharge. And this may be accompanied with some pain, and with redness and swelling of the surrounding integument. Or chronic and imperfect suppuration and softening may pervade the whole mass, instead of being limited to the surface. This however is a comparatively harmless event; seeing that the proper texture of the joint has been previously annihilated, by gradual structural change—antecedent to the peculiar deposit, or at least coexistent with it. What was the joint may be opened into; but the circumstance will not be marked by any of those serious consequences which would be certain to accrue did any part of the synovial apparatus remain.

Such concretions, when fairly formed, are plainly but little amenable to local treatment. The great object is to prevent their formation; by constitutional management directed against their cause, the gouty or rheumatic diathesis (p. 62).

[illegible]

[illegible] by either a rapid or [illegible] of the other struc- [illegible] of absorption or disor- [illegible] disease.

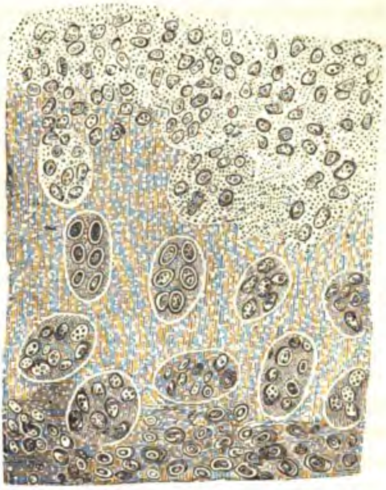
[illegible] in themselves desti- [illegible] and difficulties as to their [illegible] connected with them. In [illegible] process can never [illegible] and it has even been [illegible] are either mechani- [illegible] worn away by attrition; [illegible] being dissolved [illegible] On the other [illegible] changes take [illegible] circumstances, it is [illegible] the seat of [illegible] he had demonstrated [illegible] had previously been [illegible] as well as Mr. [illegible] may take place in carti- [illegible] changes to be in some [illegible] on the [illegible] in the non-vascu- [illegible]

[illegible] that these incon- [illegible] eminence, are to be [illegible] imperfect views of [illegible] in the economy, which [illegible] continue to withhold many [illegible] facts which have been [illegible] physiologists, that nutrition [illegible] and powers inherent in [illegible] and that the blood- [illegible] of nutrition, as they [illegible] The power of nutr- [illegible] and the vital properties [illegible] parts of this process; [illegible] its vessels into such [illegible] elements of the tissues, is [illegible] corresponding with [illegible] In the former chapters of this work also, it has [illegible] with these views, that the different [illegible] are mostly to be regarded [illegible] changes, and consequently depen- [illegible] the nature and amount of the vascular [illegible]

[illegible] has led the way to the true pathology of articular carti- [illegible] Transactions, vol. xxvii, p. 95.

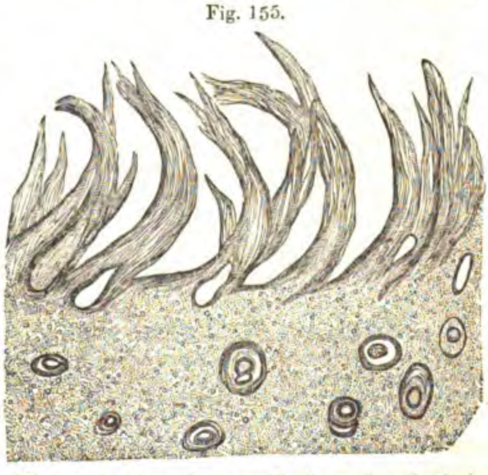
lage, by showing that the disintegration of these structures is accompanied by changes in their minuter organization, which cannot be accounted for on physical principles, and must be the result of inherent though perverted nutritive activity in the tissue itself. Cartilage is composed, as is well known, of minute corpuscles implanted with a certain order and arrangement in an apparently homogeneous intercellular substance, which has been called the *matrix*. Mr. Goodsir has pointed out, that disorganization in cartilage is invariably accompanied by changes in the form and size of these corpuscles, which become much enlarged, and more rounded than in the normal state; "and instead of two or three nucleated cells in their interior, contain a mass of them." At the same time the matrix softens and breaks up, being probably absorbed in part into the enlarged corpuscles, the more superficial of which have their walls destroyed, and their cellular contents set free. In the course of these changes, the cartilage remains entirely non-vascular; but as it gradually disappears, the exposed surfaces are very commonly occupied by a fibrous membrane, which lies everywhere in close apposition with them, and is pervaded by new vessels derived from the vascular system of the bone and synovial membrane. Sometimes this membrane is also formed between the cartilage and the bone; and in this case destruction is found to be in progress, both at the attached and free surface of the cartilage. The apparent vascularity of cartilage in disease, therefore, always depends upon the formation of this fibrous structure.

Fig. 154.



Diseased articular cartilage magnified 240 diameters, showing the enlargement of the corpuscles, the more superficial of which are throwing out their contents into the softened inter-corpuscular substance.—Redfern.

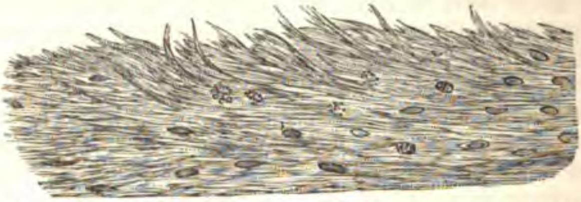
Fig. 155.



Microscopic view of a perpendicular section of articular cartilage, showing its surface occupied by fibrous bands formed by the splitting of the hyaline substance. These bands rendered it velvety in appearance to the naked eye.—Redfern.

Dr. Redfern of Aberdeen has recently published a memoir on the morbid processes in the articular cartilages, in which the whole pathology of these structures is most carefully and elaborately illustrated. He gives numerous examples of the changes in the cells mentioned by Mr. Goodsir; and also of the formation of the vascular membrane above adverted to. Dr. Redfern has likewise investigated very closely the changes taking place in the matrix or intercorpuscular substance. This, which in the normal state is of homogeneous aspect and nearly structureless,[1] appears under the influence of disease to split up into bands and fibres; these are often found in partially and slightly diseased joints, giving a soft and velvety aspect to the surface of the cartilage.

Fig. 156.



Fibrous tissue with included cells and nuclei; formed, as above described, on the surface of the cartilage of the patella.—REDFERN.

Fig. 157.

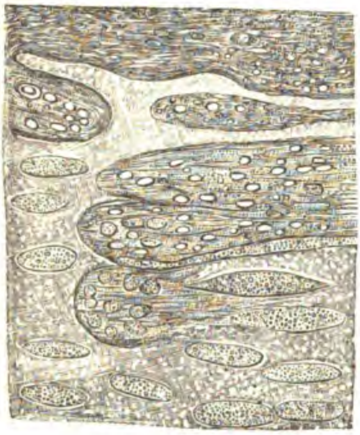


Fig. 158.

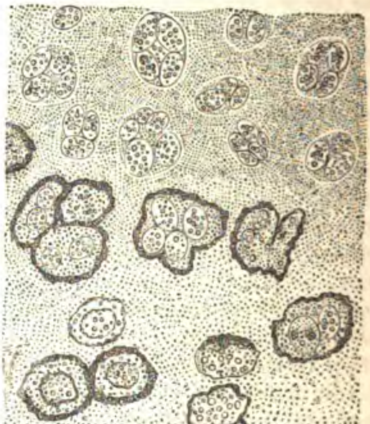


Fig. 157. Vertical section of cartilage in a diseased knee-joint, showing the cells enlarged, granular, and bursting. On the right, and above, their contents are seen mingling with a fibrous and granular mass which occupies the surface.—REDFERN. Fig. 158. Deposition of opaque calcareous matter, commencing in the walls of the cartilage corpuscles.—REDFERN.

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[1] Dr. Leidy of Philadelphia has very recently described the hyaline matrix of cartilage as possessing a minutely fibrous structure in the normal state. He also describes a process of multiplication of the cells in the development of cartilage, which appears to be connected with normal growth. Should these observations be confirmed, the analogy between the normal and morbid process will become very apparent.—*American Journal of Medical Sciences, April*, 1849.

As the disease proceeds, the altered hyaline substance becomes full of nuclei, which are the result of the bursting and discharge of the corpuscular contents; and these two elements combine to form the fibrous and vascular membrane which is found in contact with the cartilage in such cases. This membrane is not, therefore, as Mr. Key supposed, the agent of disintegration, but the result of it.

The nuclei of the cartilage cells are not unfrequently, according to Dr. Redfern, converted into fatty granules; but the most important change is their elongation and transformation into fibres, by being incorporated with the altered hyaline substance. Another change occurring in many diseased cartilages is the infiltration of them with amorphous mineral matter, chiefly phosphate of lime; which probably forms when abundant the porcellanous deposit to be hereafter described.

Dr. Redfern is of opinion that pus is never formed in diseased joints, when the cartilage *alone* is affected; the sole results of the morbid process being the fibres and altered contents of the corpuscles, as above mentioned. He also thinks that the disintegration of cartilage, unattended by disease of the synovial and other tissues, is a very insidious process, giving no pain, and producing neither swelling nor any marked symptoms. Such disease, in its commencing stages, is probably not uncommon; although in the course of its progress it generally leads to the affection of other tissues besides that originally involved.

An extensive series of experiments on the lower animals has given, in Dr. Redfern's hands, results so similar to those of the observations in the human subject, as to entitle the latter to increased confidence. It appears that all sorts of injuries inflicted upon the cartilages (whether those of the joints, or the costal cartilages) produce the same changes in the hyaline matrix, and in the cells, as have been above described; and that after periods of from one to several weeks, or even months, repair may be established; the fibrous tissue formed by the splitting of the matrix, and discharge of the corpuscles, taking the place of the destroyed cartilage. This is evidently the same process as takes place in diseased joints.

These general remarks on the alterations in structure of articular cartilages, are necessary to enable the reader advantageously to follow the details of description to which we now proceed.

I. *Simple Destruction of Cartilage.*

This is most commonly a very chronic process. It commences in the free surface of the cartilage, leading to little pain, or perhaps none, if the cartilage alone be involved; unattended by any purulent or even puriform secretion; and consequently giving rise to no swelling. This state of matters may exist for weeks or even months. Then, however, the morbid process becomes more extended, and the symptoms are more severe. The bone may have been laid bare, or the disease may have extended to the synovial apparatus; a true inflammation is lighted up; pus is formed; and destruction of the cartilage in a more rapid form is established, characterized by pain, swelling, and fever.

The characters of the disease thus established may vary according to its extent. When limited, it is often of a circular form, and seeming as if a chemical erosion of the tissue had there occurred; without any sign of attempted repair. The affected surface is usually villous or velvety, even to the naked eye; and under the microscope shows the bands and fibres arising from the splitting hyaline substance. When the affection is very superficial, much of the cartilage may present this character without any other mark of disease. When the tissue has been perforated, the subjacent bone is exposed; and the characters are those of ulcerated bone surrounded by irregularly disposed cartilage. The synovial membrane, in the immediate vicinity, is red, swollen, and pulpy; plainly undergoing inflammatory change of structure. The parts most prone so to suffer are those most liable to pressure—for example, the inside of the head of the tibia, and the corresponding points of the condyles of the femur.

Healing may occur in different ways. 1. In the superficial and limited forms, there is little or no appearance of exudation, and the surface of the cartilage remains permanently somewhat rough and villous; the edges of the erosion, however, becoming bevelled and flattened by absorption. 2. When destruction is more extensive and the synovial tissues are involved, plasma is thrown out, which probably contributes, with the alteration of the hyaline matter of the cartilage itself, to form a fibrous membrane which partially fills up the chasm and becomes incorporated with the surrounding parts. In no case is there any reproduction of true cartilage. 3. When disintegration has penetrated to the bone, and also perhaps involved that texture somewhat, a similar cicatrix results; but with this difference, that the new matter is not furnished by the soft textures but mainly by the hard. The bone then throws out plasma; osseous nodules result therefrom, and occupy the exposed surface of the bone. These do not rise to fill the chasm, but remain limited and low, becoming smooth, and rounded off on their surface. Exterior to this new osseous layer, there may or may not be a plasma for the synovial tissue, becoming organized, and constituting the medium of incorporation between the hard and soft parts. 4. Or there may be no depression of the cicatrix, and no investment of it by adventitious soft texture. The place of the cartilage may be taken by a hard amorphous substance, like ivory, which has to bear the friction of the opposed surface, on resumption of function; and becoming unusually dense and smooth on the surface, by deposit of earthy matter of a peculiar kind, it is termed porcellanous—the surface, which is thereby formed, proving smooth and fine as that of porcelain. This is doubtless inferior to the elasticity of cartilage and the lubricity of its investing synovial membrane, but yet is a wonderfully efficient substitute. 5. Or the healing process may be of a fifth kind. Often deep erosions of cartilage exist at opposite and corresponding points of the articulation. From these, fibrous or osseous reproductions, springing up, are not unlikely to coalesce, causing fixity of the joint by anchylosis.

Sometimes death of cartilage, in continuous mass, complicates and aggravates the process of disintegration. In such cases, doubtless, the initiative has been in the subjacent bone; destruction has thence begun on the deeper part of the cartilage, and may have extended much more in a horizontal than in a vertical direction. Thus a portion of the cartilage becomes attenuated and undermined; and, following a like course with skin, or any other texture similarly circumstanced, dies. By continuance of the loss of substance, the dead portion is ultimately detached; and, becoming loose in the joint, adds to the mischief already there what is sure to result from the presence of extraneous matter within an inflamed synovial cavity.

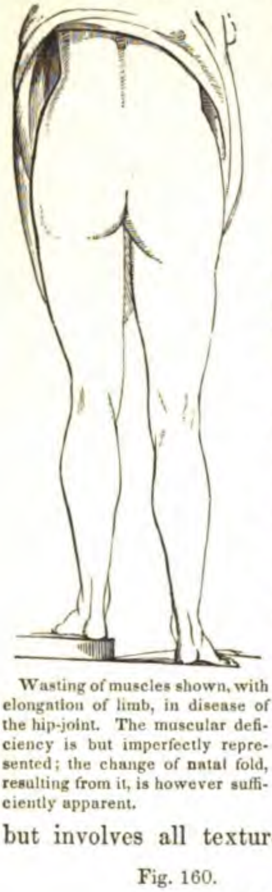
The *symptoms* of such change of structure in articular cartilage are very distinct from those of affection of the synovial membrane. With ordinary care, they need never be confounded. As already stated, in the advanced stage of joint-disease, when all textures are involved, there is no means of ascertaining by present symptoms the original and chief seat of the malady; but while the morbid process is advancing in one texture, and as yet limited to that, the diagnostic signs of its presence and nature are usually plain enough. Be it remembered, however, that the symptoms of destruction of cartilage, although invariably indicative of that affection, are not always indicative of its amount, because not uniformly proportioned thereto. They rather indicate the amount of disease in which the other textures of the joint have been involved.

The symptoms are found to accord with the chain of pathological events formerly stated. At first there is dull and deep uneasiness in the part, with some impairment of motion; but without swelling or other apparent change of structure. This state may continue for days, or even weeks, with but little change. Then the uneasy feelings become more marked, and are aggravated nocturnally. The pain is undoubted; deep, constant, worse at night; usually referred by the patient to one particular spot deep in the joint, and likened by him to the unceasing gnawing of an animal there. Acute pain comes with the advance of the inflammatory process towards its crisis, and keeps pace with it. It is aggravated by motion, more especially if great and sudden; and, on gentle movement of the part, a grating sensation is ultimately perceived, in consequence of exposure of opposing points of bone. Very frequently there is sympathetic pain complained of, sometimes fully as much as of that in the part—an example of irritation in one part, induced by inflammatory change of structure in another (p. 76). Pain in the knee, for example, is usually the most prominent symptom of disease in the hip; pain in the leg may mask destruction of the cartilages in the knee. The whole of the limb beneath the affected joint is usually both functionally and vitally weak; feeble and tottering; of diminished temperature, and inclined to œdema.

Wasting of superimposed muscle is often both a prominent and early symptom of articular disease; atrophy of the deltoid, for example, may be the first to betoken destruction of cartilage, of bones, or of both, in the shoulder; and flaccidity of the glutei does the same in regard to morbus coxarius. In the child, however, we must be on our guard against mistake on this point; inasmuch as muscular atrophy not unfrequently occurs, in early life, altogether unconnected with articular disease; dependent on dentition, or on intestinal irritation.

Swelling does not appear till uneasy sensations have been present in the joint for three or four weeks, it may be for months. It follows the steady aggravation of pain which indicates the advance of the disease; and is both less bulky, and less rapid in its formation, than that which attends on synovitis. It is composed of two parts; one internal, caused by gradual distension of the synovial pouch by slowly accumulating pus; another external, from interstitial effusion in the textures exterior to the joint, these being now involved in a tolerably active sympathetic affection. In consequence of its double and gradual nature, the peculiar bulgings dependent on the natural conformation of the joint do not occur; a diagnostic mark between this affection and chronic synovitis. In acute synovitis, swelling is tolerably uniform; but at the same time it is great, rapid, and coeval with the occurrence of pain; whereas in destruction of cartilage, it is slow, gradual, never great, and long subsequent to the feeling of uneasiness in the part. In chronic degeneration of the synovial membrane, on the other hand, the swelling is slow, and somewhat uniform; but still it is coeval with uneasiness, and elastic, doughy, and superficial—not deep and obscurely fluctuating, like that which attends on destruction of cartilage. The latter swelling, too, is intolerant of pressure, pain being thereby much increased; the other, on the contrary, is capable of bearing manipulation with comparative impunity.

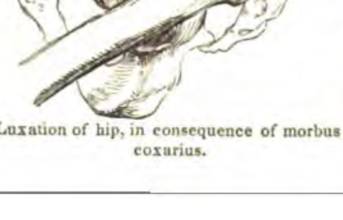
Fig. 159.



Wasting of muscles shown, with elongation of limb, in disease of the hip-joint. The muscular deficiency is but imperfectly represented; the change of natal fold, resulting from it, is however sufficiently apparent.

When swelling has become fully established, the disease is no longer limited to the cartilage, but involves all textures. Pus accumulates; deposit and change of structure take place in the synovial membrane and textures exterior; ultimately, by ulceration there, the fluid escapes from the joint, makes its way to the surface, and is thence discharged; not without loss of substance in the ligamentous texture, as well as relaxation of that which retains its integrity, causing extreme laxity of the articulation. In consequence of this laxity, the joint, which previously had assumed the position of semiflexion, as in affection of the synovial membrane, may become wholly luxated; the flexor muscles having then to encounter but little opposition to their displacing force; and ordinarily there is also

Fig. 160.



Luxation of hip, in consequence of morbus coxarius.

more or less rotation, or other displacement; one muscle, or set of muscles, exerting a supremacy of power. Thus, in such affection of the knee, the bones of the leg are dislocated backwards into the popliteal space; and at the same time the head of the tibia is usually rotated outwards, by the preponderating action of the biceps flexor cruris.

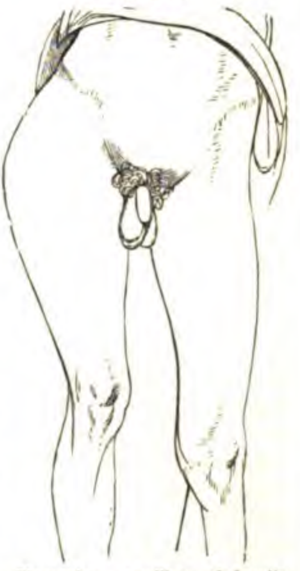
Such important local changes are not unattended with sympathy of the system. At first, the constitutional symptoms are but slight; little more than general discomfort, or slight feverishness, being complained of. But when pain becomes undoubted and steadily crescent, inflammatory fever is declared with more or less intensity; usually accompanied by involuntary startings of the affected limb—especially during sleep—by the jarring and motion of which pain is fearfully aggravated, and the inflammation hurried on in its destructive tendency. Ultimately, in the open, lax, discharging, perhaps dislocated state of the part, hectic is inevitable.

The *results* are various. Resolution may occur, at any period of the process; the disease having given way to rest and counter-irritation, without any morbid products having been poured out, and with only slight and superficial destruction. Or disintegration, having occurred, may prove but slight and transient, and function be restored; the breach being closed in one or other of the ways already noticed, and the trifling exudation, with ulcerative debris, having been absorbed. Or osseous reproduction may prove excessive, occasioning true anchylosis; the limb being retained, but permanently maimed in the function of its articulation. Or the inflammatory destruction may ultimately become both so general and so great, and the constitutional sympathy so formidable, as to banish all hope of saving the part, even with impaired form and function; compelling us to direct our attention solely to the saving of life, by dooming the member to early amputation.

The affection may be idiopathic. More frequently it is attributed to external injury; perhaps slight; probably neglected. Exposure to cold, too, is favorable to its induction; as are both the mercurial and syphilitic taints of system. It is more frequent in the adult than at an early age.

Treatment.—The obtaining of a complete immunity from all motion, by the adaptation of splints, is the paramount indication from the beginning to the end of the cure. Local depletion is had recourse to; partly on its own account, but chiefly as preparatory to counter-irritation, which is doubtless entitled to the first place among the directly remedial agents. The vesicant form of counter-irritation we found to be most suitable for affections of the synovial membrane. In this disease, a

Fig. 161.



Shortening, swelling, deformity, lameness; the advanced stage of morbus coxarius.

higher grade, the pyogenic, is required. Issues are the form generally in use; and they may be established by either the potential or the actual cautery; the former is in the greater number of cases equally effectual with the latter, and being milder in application is to be preferred. But in the larger joints, and in others where mild means have already been ineffectually used, let the graver remedy certainly be employed. The cure is invariably tedious; and, consequently, the counter-irritation, with other means tending to its attainment, require to be patiently continued. It is not enough to establish an issue, and then leave it to heal or not according to circumstances. For some time, often considerable, the irritation and discharge must be continued from the surface; and this may be effected in one of two ways—either by forming a succession of fresh issues, or by maintaining an open state of the one originally made. The latter method is most commonly followed; equally effectual with the other, less troublesome to the surgeon, less painful to the patient. The discharging surface is dressed from time to time with some irritating ointment or lotion, as the savine, tartar emetic, &c.; or it may be retouched occasionally by the potass or other caustic. This last mode of refreshing the sore is probably the best; the inflammatory reaccessions, thereby induced in the surface, being of service, as well as the maintenance of sufficient purulent discharge; it is generally our object in these cases, not to obtain either counter-irritation or evacuation alone, but a combination of both. Also, let us at all times beware of placing the artificial sore too near the joint; otherwise we shall fail in counter-irritation, and apply a direct stimulus to the disease (p. 160). Constitutional treatment is at the same time employed, according as circumstances may demand; at first antiphlogistic, afterwards cautiously roborant. When, in the early stage, much pain and spasm exist, full opiates are indispensable; as the continuance of either must inevitably lead to the aggravation of the disease.

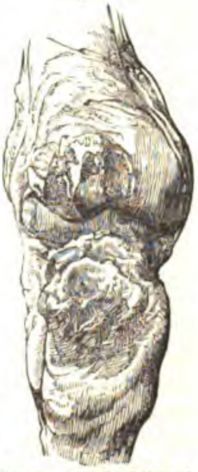
In the more favorable cases, such treatment is slowly followed by gradual amendment; the pain abates, and ultimately ceases; the constitutional symptoms also disappear; swelling yet remains, but softer, indolent, and infinitely less painful, even on pressure. When this state of quiescence has been reached—the inflammatory process having ceased, and its results merely remaining—counter-irritation is to be desisted from. The issues are allowed to heal; the splints are retained, still to control motion; and pressure, by the method formerly mentioned (p. 438), is had recourse to, in order to hasten absorption of deposit, and consequent return to the normal state. At first, however, pressure must be applied with especial caution, lest acute accession ensue; and if this threaten, the original treatment must be at once renewed. When not only the inflammatory process, but its products also, have been removed, motion is restored; but not till then; passive at first, gentle, and brief; at once desisted from on the occurrence of serious and continued pain. A certain degree of uneasiness invariably attends on resumption of motion, however cautiously conducted; but that is not to deter from perseverance in its use. Only when the sensation is that of undoubted pain, deep and constant as before, not in any marked degree diminishing on cessation of the motion, are we warned of dar premature employment of the last item in the cure; and su at all times sufficiently plain, we are never to neglect. The splints are again resumed; as well as leeches and counter-irritation, if need be; and all movement is as scrupulously avoided as before; otherwise back will come the ravages of renewed disease, perhaps in an aggravated form. Such intercurrent inflammatory accessions are by no means unfrequent; and not always the result of malapraxis. They sometimes supervene on the quiescent state of the joint, without any assignable cause; but, however induced, they are invariably to be met by a corresponding vigilance and propriety of treatment.

In the open condition of the ulcerated joint, cure is by no means hopeless. The probability is that motion will be permanently impaired to a certain extent; but we have usually good hope of retaining the part; amputation, nowadays, is not the rule but the exception, even in this class of cases. After the establishment of the open state, not unfrequently the disease advances with increased virulence for a time, as formerly stated; and this exacerbation, expected, is to be met and subdued in the ordinary way. Afterwards, by rest, constitutional treatment, and, if necessary, counter-irritation—in addition to the evacuant remedy which has spontaneously formed—the quiet condition is attained. And then the treatment by compression will often be followed by the happiest results; subsidence of swelling, gradual disappearance of all uneasy sensations, closure of the apertures, and diminution of the discharge.

The compressing apparatus is applied in the ordinary way (p. 439), and does not require unusual frequency of renewal; the discharge in the truly quiet condition of the joint—to which state alone such treatment is applicable—being inconsiderable, and not tending to accumulate injuriously beneath the dressing. Under such circumstances, however, it is expedient to extract all mercurial ingredients from the ointment and plaster, otherwise a constitutional influence may be induced unnecessarily by that mineral; the open state of the part being very favorable to absorption. After satisfactory amendment under the compressing plan, motion is to be cautiously attempted. In some cases we may succeed in restoring it completely; in others it is incomplete, stiffening being to a certain extent insuperable, partly from alteration in the joint itself, partly from structural change in the ligamentous and other apparatus exterior; in not a few, motion is scarcely if at all regained, true anchylosis having occurred.

In some cases—but much more seldom than in the scrofulous destruction of cartilage and subjacent bone—there is no hope of cure, even by anchylosis. The disease will, as it were, accept of no compromise, but insists on complete disorganization of every texture. If the part be accessible—as the knee—it is to be removed by the knife, ere yet the system have been irretrievably involved in the downward progress; if inaccessible—as the hip—we can then, in most cases, palliate what we cannot cure. The constitutional s are to be subdued by the ordinary means. nter-irritation, as well as depletion, are

Fig. 162.



Destruction of cartilage, in the knee-joint.

not to be thought of; but rest is all important. By the skilful adaptation of splints, so as to secure immunity from motion, yet without galling the part or annoying the patient, and not interfering with facility of dressing requisite for cleanliness, much amelioration is obtained. Life is not only made infinitely more tolerable, but may be protracted for even a considerable period. Even in the most hopeless cases, decided benefit will not fail to show itself; and in some, at first apparently irremediable, the amendment may be both so marked and so sustained, as not only to warrant the entertainment of a hope of cure, but even to carry that out to a tolerably successful issue; the joint may dry, and stiffen, and be consolidated—both life and limb are retained.

In any case of urgency, whose circumstances point to early amputation, it behooves us to consider, before determining on that extreme measure, that it is possible the counter-irritant treatment may have been carried too far, and that this may be the cause, at least in part, of both the local and constitutional aggravation. Accordingly it is expedient, in the first instance, whenever circumstances permit, to abandon all active treatment—allowing the issues to heal, and maintaining absolute rest of the part with due regard to the system; and to let an interval of repose declare whether the urgency has arisen from the progress of the disease, or from excessive action of the means of cure—intended counter-irritation having proved directly irritant to both part and system. If the issues have been in fault, the symptoms will satisfactorily subside, during this interval; amputation, in consequence, is not only deferred, but may be rendered altogether unnecessary. If, on the other hand, no amendment follow the cessation of active treatment, amputation is unhesitatingly performed.

In those cases in which cure is slowly advancing by anchylosis, it is very important, with a view to the future usefulness of the limb, to have regard to the position of the joint. In the elbow, for example, we prefer neither complete extension nor extreme flexion, but an intermediate angular position; the limb, when so fixed, being most favorably disposed for prehension. The spontaneous flexion of the knee, on the contrary, will be gradually undone, and yet full extension not desired; the limb, when slightly bent, so as to permit weight to rest on the ball of the foot, being the posture most suited for progression.

When cure has resulted, with fixity of the joint, whether in a favorable position or otherwise, a question arises as to the propriety of attempting to overcome the rigidity, and restore motion. When anchylosis is osseous and complete, the question may be unhesitatingly answered in the negative. Disruption of the osseous interlacement could only be effected by violence, such as inevitably to induce the inflammatory process, probably of a grave kind, in a part whose power of control has been greatly impaired by previous and recent disease; the process of disorganization advances anew, and the joint is lost. When, however, the anchylosis is imperfect, or fibrous, restoration of function is to be attempted cautiously, yet with determination, by the ordinary means—to be considered when treating of anchylosis.

Complete anchylosis having been undeniably and hopelessly established, still a question may arise, whether or not the part is beyond the reach of our remedial art. The original joint having been thoroughly obliterated, and all the textures enjoying a complete immunity from inflammatory disease and tendency, may not an incision be made immediately beneath the stiffened joint, the bone be there sawn across, and the case subsequetly treated so as to establish there a false articulation —inferior doubtless to the original, yet still capable of assuming at least some of its functions and utility? This has been practised by Mr. Barton, of America, with success; section of the neck of the femur having been made in anchylosis of the hip-joint. But further experience is yet required, ere such procedure can be said to be as expedient in practice as feasible in theory. And even supposing that its general safeness shall have been established, it would yet remain obvious that all joints are not amenable to the experiment.

Acute Destruction of Articular Cartilage may be either original or secondary, as to texture. That is, it may either be an accession on the more common chronic form, originating in the cartilage itself, by the slow and gradual process just detailed; or it may follow on disease of the synovial apparatus, the cartilage having been in the first instance altogether unimplicated in the morbid change. It may also be the result of united disease of the bone and synovial apparatus; and in such cases is of course peculiarly severe. Such secondary destruction is usually both acute and extensive; not unfrequently accompanied with partial death of the cartilage; this aggravating all the symptoms, and accelerating the joint's disorganization. It may be, that after evacuation of the purulent formation, in the open state of the joint, all disease in time subsides; the secondary affection of cartilage and bone may then abate, as well as the primary disease of the soft parts; and hopes of cure may be reasonably entertained. But it is plain that cure, under such circumstances, can be only imperfect—by anchylosis; the destruction having been both too wide and too deep to admit of simple cicatrization.

Could we always be certain of the signs of acute suppuration in synovial affections, an early incision might often arrest, or at all events greatly limit, secondary acute destruction of cartilage. But unfortunately, we are seldom satisfied of our diagnosis, until some time after the event; when the matter has collected in considerable quantity, and is already approaching the surface with a view towards its own evacuation. Our duty then is to evacuate; soothing the excitement which will necessarily follow the wound, by rest, and by antiphlogistics proportioned to the exigencies of the case; and endeavoring by subsequent continuance of rest, and employment of the higher grades of counter-irritation, to arrest the destruction which we have not been able to avert. Such incisions may be made very freely, and with good effect. The matter is allowed thorough vent; detached portions of cartilage, with other debris of texture, are evacuated; and, after the immediate excitement of the wounds has subsided, all is plainly favorable to the process of cure—whether by anchylosis or otherwise.[1]

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[1] *Vide* Gay, Lancet, No 1473, p. 494.

II. *Scrofulous Destruction of Articular Cartilage.*

This may originate in one of two ways. It may follow on the chronic gelatinous degeneration of the synovial membrane. Or it may be the result of scrofulous disease in the cancellated texture of the articulating extremities of the bones; at first chronic, ultimately acute and rapid in its destructive progress. The latter is the more frequent, and by far the more formidable affection.

In the former case, there are at first the ordinary symptoms of the indolent scrofulous degeneration (p. 438). Then pain, deep-seated and severe, supervenes; the constitution seems inclined to assume a more intense and sthenic form of sympathy than before; the swelling increases, and there are undoubted signs of roused activity in the part. Ultimately the swelling grows fluctuating, denoting that pus has formed in the joint; this seeks the surface, and is discharged; and then the work of disorganization is likely to advance, till all the textures have been irreparably involved. In the advanced stage, the joint becomes peculiarly lax; previously, it was rigid and comparatively motionless; now it may be moved freely in any direction, and that with comparatively little pain; partly from destruction, partly from relaxation of the ligamentous and other textures exterior. Luxation consequently is not unfrequent, in the end.

Or the indolent stage may continue, while yet the cartilage is extensively removed; this being effected by simple absorption. Rapid destruction is, however, at all times prone to supervene—perhaps under the influence of some trivial exciting cause, as a slight blow or wrench—along with suppuration and its usual results.

When the morbid change originates in the cancellated texture of the articulating extremities of the bones, there is usually a considerable period of comparative repose. Tubercular deposit sometimes occurs, filling the cancelli; very frequently, however, the bone is or appears simply inflamed or carious, without any distinct morbid deposit. This condition is accompanied with dull aching in the part, swelling, and impairment of function. The bone at that part manifests enlargement; partly real, in consequence of a certain degree of expansion, induced by the tubercular infiltration; chiefly apparent, however, on account of the atrophied condition of the muscles and other soft parts. To this condition the term "white swelling" may perhaps be most truly applied; the joint being large, weak, and deformed; and the skin, sometimes showing large veins beneath, being stretched over the deep swelling, of a pale white hue. The infiltration of the soft parts, exterior to the joint, is not by serum, but by solid fibrinous deposit; the result of a chronic, not of an acute sympathetic inflammatory process; the work not of days, but of weeks, perhaps of months. After this state has existed for some time—often for months—exacerbation takes place; pain is greater and more constant; motion is denied; swelling of the soft parts is greater, and more apparently the result of an inflammatory process; sleep is disturbed, and spasmodic twitchings threaten; the constitutional symptoms are aggravaed, and for a time display the ordinary characters of smart inflammatory fever—modified, it may be, by the previously existing cachexy. The commencement of this exacerbation is coeval with suppurative disintegration of the bone; its crisis corresponds to purulent irruption into the cavity of the joint, the matter having made its way thither by means of ulcerative destruction of the intervening bone and its cartilage. Not unfrequently necrosis is combined with the ulceration, and dead portions of the cancelli lodge in the articulation. Then the ordinary ravages ensue; inflammation, suppuration, and ulceration beginning in the bone, but forthwith invading every texture; and usually destroying all, with a rapidity proportioned to the diminished power of both part and system.

The joints most prone to suffer, are those in which the cancellated texture enters most copiously into the composition of the articulating ends of the bones.

The scrofulous destruction of cartilage, inasmuch as it depends mainly on vice of the system, is liable not to remain limited to the joint originally attacked; but to affect several, either at once or in succession. For a like reason, the disease is most frequently met with during the period of adolescence.

Treatment.—Our principal object, in the early stage, is prevention. In the case of the gelatinous degeneration, to effect arrest and resolution of the morbid process, ere the cartilage have been involved. In the tubercular infiltration, to preserve that in the crude state, and if possible to obtain its absorption; averting the softening and suppurating process; or at all events limiting and moderating it; and perhaps, should it occur, preventing its invasion of the joint's interior. Rest, maintained by splints, absolute and constant; moderate local depletion; counter-irritation, of the higher grade, patiently sustained, and cautiously conducted, as to time, place, and mode, so as not to overact its part; judicious and persevering employment of such remedies as are best adapted to overcome or palliate the scrofulous diathesis:—these constitute the means of treatment.

When suppuration has occurred and disorganization becomes established, the general principles of surgery are to be sustained. By timeous incision, the purulent fluid is to be effectually evacuated; that we may if possible limit what we cannot avert. The subsequent symptoms are to be palliated, by every means in our power, both general and local; and cure by anchylosis is hoped for.

In those cases in which it is plain the part cannot be saved—and in this, the scrofulous form of open joint, unfortunately these do not constitute the minority—amputation is naturally looked to as the only source of hope; that by sacrifice of a part, a mutilated whole may still be saved. But careful inquiry and reflection are necessary, ere this resource can be duly determined on; otherwise it may happen, that by removal of a part we do not succeed in preserving the whole, even for a time, but on the contrary greatly accelerate its decay. It may be that the frame is irrevocably the victim [illegible] ercular cachexy, and doomed sooner or later to perish there [illegible] the time relieved or sustained by the breaking out of a dr [illegible] y valve, in the suppurated scrofulous joint, whereby the i [illegible] it is extruded, with comparative impunity; exhausting th [illegible] sense, it is true, and inducing marked hectic, under which [illegible] st ultimately be prostrated; but still keeping back the [illegible] bstacle to life, of tubercular deposit in an internal organ—lungs, liver, kidneys, or all. Such deadly internal disease may be only threatened as yet; and the open joint may delay its invasion. Or the phthisis may be already plain; still the local discharge, if free and constant, may moderate or even stop its onward progress. Whereas, should amputation be performed, and should the wound dry and heal, the probability—nay, almost the certainty is, that the internal and more serious disorder will sustain a mighty and altogether uncontrollable aggravation, and, inducing a far worse form of hectic, hurry the patient fast into the grave. With the open joint, he might have lived for months, in comparative ease; without it—supposing the operation to be in all respects locally successful—days, or weeks at most, will see his doom. Ere amputation be definitively resolved on, therefore, let there be a careful review of the patient's past history and present circumstances; let the state of the internal organs—more especially of the lungs—be diligently inquired into; and if these appear free from tubercular disease, as well as from strong predisposition thereto, let the operation be undertaken, hopeful of success; but if, on the contrary, the internal organs be plainly already involved, and that seriously, let us by all means refrain from amputation, and content ourselves with palliation of the more distressing and urgent symptoms. When there are strong marks of predisposition, but yet no decided evidence of the internal disease, expediency of operation is at all times doubtful; and the question can only be rightly resolved by deliberate use of judgment and experience. When amputation is performed, immediate union of the wound by adhesion is plainly not desirable; sudden drying up of the long-continued discharge might seriously incommode the system; we seek suppuration and granulation, and, by that mode of healing, have a gradual transition to local soundness.

In acute synovitis, we found that the free internal use of mercury, so as to produce its constitutional effect, was in many cases advisable in order to save texture. In decided simple destruction of cartilage, also —more especially of the acute kind, or tending to assume that character —its use may be expedient. But to this scrofulous degeneration of cartilage and bone, we deem it wholly inapplicable. The scrofulous system has no tolerance of the remedy; attainment to the locally beneficial effect is more than doubtful; and the unguarded attempt is likely either to fail in its object altogether, or only to achieve it imperfectly, while at the same time the system receives a severe and perhaps irreparable injury.

Hypertrophy of Cartilage.

Articular cartilage, like cuticle, a non-vascular tissue, may become preternaturally developed, either generally, or only at certain points. The parts most prone to undergo this change, are those where pressure is habitually the least; as on the patella. The free surface is often less smooth and polished than in the normal state; dull, and almost villous in its aspect. The affection may occur at any age. The symptoms are obscure; dull uneasiness, perhaps a very slight degree of swelling, impairment of motion, and a feeling of weakness in the part. The treatment will consist of rest, the minor forms of counter-irritation, and attention to the general health; and the iodide of potassium is likely to be of use, both externally and internally. Afterwards, friction, and support of the part by bandaging, or by the elastic yet close-fitting knee-cap, will be advisable.

Atrophy of Cartilage.

This occurs chiefly in the old, at the points habitually most compressed; and the aged who have led a laborious life, much in the erect posture, are the most prone to suffer. The joints of the lower extremity, especially the knee on its inner part, are the most frequently affected. It is with difficulty distinguished from the slighter forms of destruction already described. Very frequently, rheumatism seems to be concerned in the change. At first the cartilage seems to be opened up in texture, the absorption being decidedly interstitial; afterwards the normal density is resumed, but with diminished bulk. The cartilage may be merely thinned, in stripes or patches, continuous or detached; or it may be wholly removed, exposing the subjacent bone; this latter tissue however is usually entire, giving way neither by absorption nor by ulceration, but tending, on the contrary, towards a reparative effort. The symptoms are, like those of the opposite condition, obscure; rigidity, crackling sensation and noise in attempted motion, rheumatic pains, tendency to occasional puffiness by superficial œdema; inability long to maintain the erect posture, and still less to bear any considerable weight. The principal treatment will consist of kindness to old age; local support by bandaging or knee-cap; and perhaps complete rest, with light counter-irritation, for a time, should the symptoms prove unusually urgent, and the inflammatory process threaten to supervene. Long confinement and severe local remedies are inexpedient; for it is not to be expected that the atrophy will be so arrested; and the general health would surely suffer.

Porcellanous Deposit.

This may be the result of loss of substance in the cartilage; one mode of reparation being by the aid of dense deposit, assuming a vivid polish, as formerly explained (p. 448). But more frequently it follows on the foregoing affection, atrophy. The bone is exposed, by the gradual removal of the superimposed cartilage; and then, the absorbent process usually ceasing, a restorative is begun. New cartilage cannot be produced, but a very efficient substitute may; a texture not soft, elastic, and finely lubricated; but dense, smooth, and of the finest polish. In some cases, the open areolated texture of the exposed bone is retained; as if this had merely become so condensed and polished on its very surface, by dint of pressure and friction; but more frequently the existence of new deposit is plainly evinced, by closure of the areolæ, and the glistening surface is presented compact and unbroken. Very frequently the opposing porcellanous surfaces—as of the tibia and femur—fit into each other by grooves and ridges; and thus, motion becomes not only crank but limited. Deposit of osseous matter exterior to the joint is also not uncommon; another serious obstacle to function.

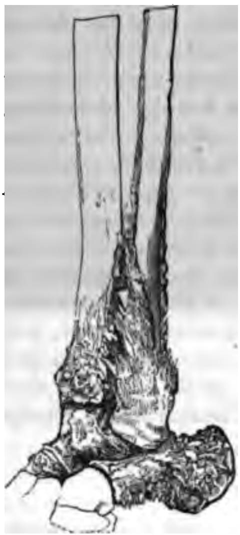
Porcellanous deposit has no real structural resemblance to true bone; it is in fact an unorganized amorphous secretion of phosphate of lime. Contrary to what might be naturally inferred, the new formation is found to contain a proportion of earthy matter not much different from that of ordinary bone.[1]

The symptoms are similar to those of the most usual cause—atrophy of cartilage; with the addition, frequently, of a distinct grating and jarring sensation, felt on sudden motion. The treatment is the same. The rheumatic diathesis is often coexistent; and may fairly enough be blamed, at least in part, for the occurrence of the change of structure.

Osseous Deposit Exterior to the Articulation.

This may be the result of rheumatism, affecting the periosteal investment of the articulating extremities of the bones, as formerly described (p. 442). Or, like the two last affections, it may be rather the mere concomitant of old age; analogous to ossification of cartilage, as in the ribs and trachea. To the latter form, the hip-joint is especially liable. The *ligamentum labri cartilagineum* becomes ossified; deepening the acetabulum, locking the head of the bone, and greatly limiting the movement of the joint. Dislocation is rendered impossible, without disruption of the elevated brim of the acetabulum; but fracture of the neck of the femur—a more formidable accident—is, on the contrary, favored. At the same time, the bone around the acetabulum is often studded, more or less copiously, with osseous nodules of recent formation.

Fig. 163.



Chronic ostitis; serious structural change on the exterior of the affected bones. The result of chronic rheumatism.

Such a state of matters is obviously not amenable to treatment, with the hope of cure. It is sufficient that the duties of the part shall be made to correspond to its modified powers of performance; exposure to casualty, by external violence, being at all times sedulously avoided.

Interstitial Absorption of Bone, implicating the Joint.

This also applies especially to the hip-joint. In consequence of external violence, as a smart blow, or fall on the trochanter major, the neck of the femur may undergo much change by interstitial absorption. And similar alteration may occur, spontaneously; that is, without any assignable cause; seeming, like some of the affections last noticed, to be one of many signs of the frame's senile decay, not only in a mass, but in detail. This idiopathic form is perhaps most frequent in women; the greater length, and rectangular position of that part of the skeleton in them, seeming to predispose thereto. The neck of the bone is shortened; the head approaching the trochanter, till at length it seems to be set on there, without any intervening neck at all. At the same time, the angle of insertion is changed; the natural obliquity upwards becoming altered, towards the rectangular position; and, ultimately, the head of the bone descending to form an angle of a kind precisely opposite to that which is normal. The degree of shortening may vary, from half an inch to two or even three inches; and the lameness is in proportion.

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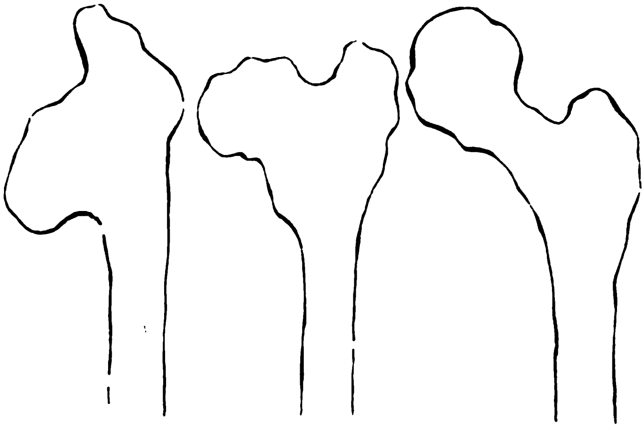
[1] See Analysis by Davy, Liston's Elements of Surgery, p. 85.

Fig. 164.



Alterations in head and neck of femur, roughly shown, in series.

Fig. 165.

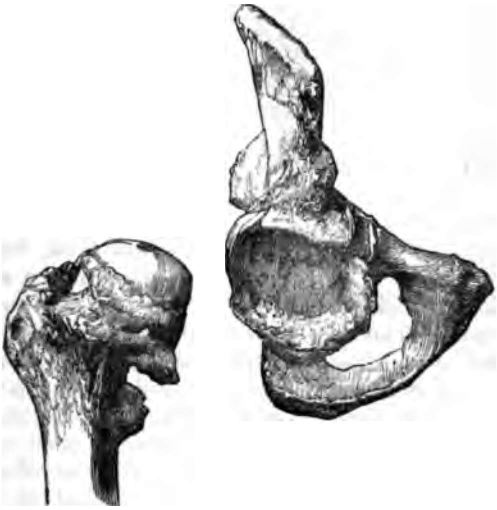


Fig. 166.

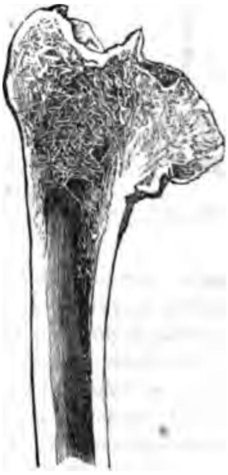


Fig. 165. Head of femur and acetabulum much altered by chronic deposit; causing shortening of the limb, and stiffness of the joint.

Fig. 166. Femur bisected; head atrophied and altered; neck gone; the result of interstitial absorption. Shortening and lameness inevitably great.

The head of the bone itself usually undergoes some change; partly by absorption, partly by irregular deposit on its articulating surface. Sometimes, also, it is studded with the porcellanous formation.

Practically, the occurrence of such change becomes of the greatest importance. For example, suppose that an elderly man sustains contusion of the hip by a fall, and is taken up lame. Fracture of the hip-joint is naturally suspected. But, on a very careful examination, the usual signs of this form of injury are found wholly wanting; and the surgeon is satisfied that the case is one of mere bruise only. Treatment is conducted accordingly. Unaware of such change, in the relation of the head and neck of the bone to the shaft, being likely to occur, the surgeon has not protected himself by his prognosis; and never thought of forwarning the patient and his friends, that by the occurrence of such change the more prominent symptoms of fracture may by and by be closely simulated. After three or four weeks of confinement, on account of the results of the bruise—for, in the aged, such time is not unfrequently required for disappearance of the pain and lameness—the patient, getting up, attempts to walk; and then, for the first time, a shortening of the limb is noticed, which may vary from less than half to considerably beyond a full inch. The surgeon is surprised, and the patient is mortified, perhaps indignant; being naturally led to suppose that his case has been mistaken, and consequently mismanaged; that what was called and treated as a bruise, was after all a fracture. Whereas, had not only the possibility but the probability of such change been known and remembered, all would have been rightly understood and patiently submitted to. The feelings of the patient and his friends, and the reputation of the surgeon, would have been alike uninjured.

Fig. 167.

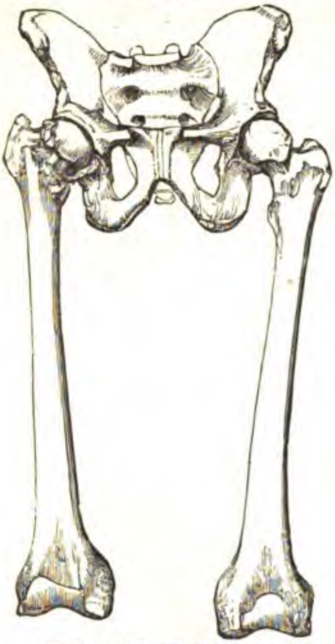


Fig. 168.

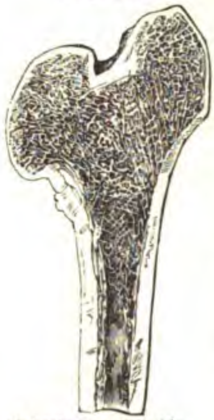


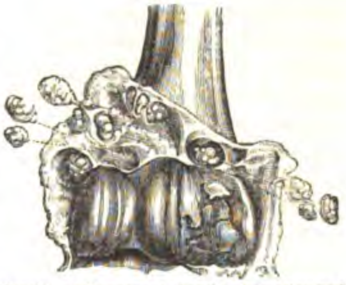
Fig. 167. Comparative view of this cause of shortening of the hip.
Fig. 168. The same isolated.

Loose Bodies in Joints.

Loose substances, usually of an irregularly oval form, are sometimes found within the cavity of articulations; and the joint most liable to this affection is the knee. They are commonly termed cartilages; but, according to Müller, this is a misnomer; their consistence being that of cartilage, but their structure distinctly fibrous. Sometimes they are of almost calcareous or osseous density. Sometimes on the other hand they are much softer, composed of a somewhat fatty tissue. They vary in size from a pea to a prune; the average dimensions are those of a flattened middle-sized bean. The surface is generally smooth; but sometimes broken by slight nodosities. Most frequently they occur singly; and seldom more than two or three are found in any one joint.

It is probable that in various ways these substances may be produced. 1. By external growth. A fibrinous deposit takes place exterior to the synovial membrane; and as it enlarges, that membrane is pushed before, forming a close envelope. The little mass projects into the cavity of the joint and is not likely to assume a pedunculated character. On a sudden movement, the peduncle may be severed; and the extraneous substance is thrown loose into the joint. 2. By internal formation, in the substance of the synovial membrane. A fibrinous mass may form in that tissue, analogous to the adventitious structures found in the "fimbriated" condition of the synovial apparatus, formerly described (p. 441); but differing from such formations in being single, instead of gregarious; and ultimately becoming much more dense in structure. It is not difficult to imagine how such a formation, at first attached, may become separate, and float loose within the cavity. 3. By epithelial growth in the joint's cavity; epithelial cells accumulating there, cohering, and growing by abstraction of nutritive material from the synovial fluid. 4. By hypertrophy of the original cartilage. Joints—especially those of the elbow and knee—are not unfrequently found in museums, with marked and irregular enlargement of their cartilage, and also of the subjacent bone, at the outer rim of the cartilaginous surface. Part of these excrescences may point towards the joint, showing more or less of the pedunculated form; and portions may be found within the joint, some quite loose, and others yet adherent. Such preparations sufficiently indicate the abnormal process whereby this mode of formation may be effected. It should also be observed, however, that such enlargement is not mere hypertrophy of the original cartilage. The texture is changed; becoming infinitely more dense and fibrous; and it is a portion of this altered tissue which is projected and detached.

Fig. 169.



Trochlea of humerus; showing formation and connection of loose cartilaginous bodies.

However occasioned, the symptoms are in general sufficiently distinct. At times there is no uneasiness; the foreign body remaining in a part of the joint removed from the play of the bones. Suddenly, however, it may become dislodged from this retreat; and, coming between the ends of the bones, on an instant the most excruciating pain is endured; the limb is rendered rigid, and motion arrested, as if by a spell. And the distressing symptoms are not relieved, until, by gentle flexion and manipulation, the intruding substance has been again placed in an unoffending position. Such occurrences, by frequent repetition, are themselves a source of much inconvenience and discomfort; and, besides, they are not unlikely to prove the means of lighting up an inflammatory process, whereby the most serious consequences may ensue. It becomes an object of some importance, therefore, either to palliate the symptoms, or, by removal of their cause, to dispel them altogether.

Treatment.—When inconvenience is not much complained of—only occasional, then not very severe, and remedied with tolerable facility, treatment should be but palliative. For operation is scarcely warranted; and puncture of such an important articulation as the knee is never wholly free from risk, however skilfully and carefully conducted. Furthermore, experience has fully proved that any operation, sakelessly although well performed, has an especial tendency towards an unfavorable issue. An elastic bandage, or tightly fitting knee-cap, is applied, and constantly worn; with the view of limiting the redundant body within its own domain—where remaining, it proves inoffensive. Should it accidentally escape, and become jammed between the head of the tibia and condyles of the femur, it is to be instantly replaced, and the apparatus resumed as before; and recumbency is advisable, for a few hours afterwards, in order that local excitement may wholly pass away.

Not unfrequently, however, palliation fails. The patient's life is rendered miserable, and himself unfit for active occupation; also organic disease may be threatened, by the oft-repeated local excitement. In such cases, the patient may urgently demand removal of the offending substance by operation; and, fortunately, his request may be nowadays agreed to, with a fair prospect of success. The subcutaneous and valvular mode of puncture is adopted; the adaptation of which form of wound, to such cases, seems to have occurred simultaneously to two surgeons, Messrs. Syme and Goyrand.

In the first place, the patient is to be prepared for the operation. For a day or two, the limb is to be disused; so that previous excitement may have thoroughly subsided. Low diet is enjoined, the primæ viæ are gently yet efficiently cleared, and general secretion is seen to be in a satisfactory state; so that there may be no predisposition to inflammation. Then the foreign body having been made superficial, is gently pushed to the extreme verge of the synovial pouch; either on the inside or on the outside of the patella, as may be most convenient. The internal position is usually the preferable; and there it is retained fixedly, by the fingers of an attentive and steady assistant. A tenotomy needle, or thin and narrow bistoury, of fine edge, is passed in an oblique direction; and an incision, a little larger than the outline of the cartilage, is made through the tense synovial membrane. The instrument is then withdrawn slowly and cautiously, the finger gently yet firmly following and consolidating its track. A few drops of blood escape, but not a particle of synovia; and no air has obtained admission, even to the areolar tissue. The integumental wound is immediately and carefully occluded, by plaster or collodion.

The foreign body is then gently pressed through the aperture, in the synovial capsule; which aperture, as has just been stated, is made sufficiently free to admit of this being accomplished without force or difficulty. When exterior to the capsule, it is coaxed through the areolar tissue—sufficiently lax, readily to admit of this—by gentle pressure of the fingers; not in the track of the puncture, but in a different direction, probably at nearly a right angle to it. When about an inch and a half or two inches, from the synovial wound, it is there permitted to remain. Not permanently, however, as has been proposed. Otherwise, acting still more as a foreign body in its recent and raw site, an inflammatory process is excited, suppuration is all but inevitable, and extension to the synovial membrane becomes extremely probable; the very result to the avoidance of which all our pains had been directed. For two days, or three at the utmost, it is suffered to remain in its new locality, undisturbed; the most careful prophylactic treatment being meanwhile employed, both generally and locally, so as to avert undue excitement. By that time, the synovial wound will have closed by adhesion; and both tracks—that of puncture, as well as that of extrusion—will have been consolidated. Then, the substance having been fixed as before, a direct incision is made upon it; not more free than is sufficient for its ready removal. After it has been lifted out, the superficial and slight wound is brought together by strap; and, in all probability, it unites by adhesion.

For some time after the operation, the limb is kept rigidly immovable, yet comfortably placed; splints being employed, if necessary, in addition to well-adjusted pillows; and the most strict antiphlogistic regimen is enjoined. Immediately after the operation, antimony or aconite may be prudently given internally, in moderate doses; and cold is applied to the part—by evaporating lotions, or by simple water-dressing—so as to insure the warding off of the much-dreaded inflammation. All bandaging, compresses, pledgets, and multiplicity of plasters, are to be avoided; being likely to engender what we most seek to avert; as will afterwards be shown.

The operation as we would advise it, is thus seen to consist of distinct parts. 1. The prophylactic preparation; occupying not less than several days. 2. The oblique valvular puncture; carefully avoiding the entrance of atmospheric air, even into the superficial areolar tissue. 3. Extrusion of the loose body into the areolar tissue, in a different route from that of the puncture; and lodgment of it, subcutaneously, at a safe distance from the synovial wound. The second and third parts of the procedure are accomplished at once, in immediate succession; and then two or three days, not more, are allowed to elapse with a view to consolidation of the wounds. 4. By a direct incision, the offending substance is finally removed from its temporary abode. It is not at once taken away, through the original puncture, because it would be in most cases very difficult to accomplish this without the admission of atmospheric influence; the almost certain consequence of which would be synovial inflammation, of an intense kind, ending in suppuration and loss of the joint. And, as experience has proved, it were alike unsafe to leave it unremoved from its secondary and subcutaneous abode; it being extremely probable that an effort would be made by Nature, to dislodge it thence, by the ordinary means of inflammation and suppuration of the textures around. And then we should, probably be unable to prevent involvement of the synovial membrane.

Or the operation may be performed by two punctures, as recommended by Mr. Liston. "The knife is made to penetrate the skin, by directing its point perpendicularly to the surface, and somewhat more than an inch below the substance to be acted upon. By a lateral motion of its blade, the integument is freely separated from the adjacent parts, so as to make a bed for the lodgment of the cartilage, somewhere over the space between the tendon of the biceps and the vastus externus. The point of the instrument is then directed to the foreign body, and made to impinge upon it, so as to divide all the interposed tissues and the synovial capsule *freely*, somewhat in the direction of the limb.

"The instrument is then withdrawn, and the assistant places the point of a finger on the minute opening. The knife is again introduced towards the outer side, and so managed as to complete a pretty large crucial incision of the immediate coverings of the body to be removed. This done, nothing remains but to pass the point of the instrument under the mass, to entangle it, to withdraw it from the joint, and to carry it into the bed previously prepared for it."[1]

By another mode, a cure might be obtained. Were a patient averse to cutting instruments, and yet much annoyed by the disorder in question; or were any other circumstances to exist, rendering the propriety of even subcutaneous incision questionable; the foreign body might be permanently secured in a safe part, by transfixion. The same preparatory treatment having been employed, and the cartilage having been similarly fixed, in a favorable locality, a hare-lip pin, or finer needle, may be passed through the integument, so as to entangle the surface of the body in its hold; or, should the consistence of this prove not great, it may be more completely transfixed. A few turns of a thread will suffice to keep the needle in its place. After some days, it is gently withdrawn; and rest, with antiphlogistic regimen, is strictly maintained. Sufficient excitement is induced for fibrinous exudation, of a plastic kind, along the track of the needle; and thereby the previously movable substance is fixedly incorporated with the parts, becoming permanently resident where its presence can produce little or no inconvenience.

Mr. Syme, acting on this principle, has succeeded in fixing the foreign body in a safe place, by means of subcutaneous incision of the capsule over it, and the application of a blister to the skin.[2]

As already stated, no operation is expedient unless in troublesome cases, and with much precaution. For experience has shown that even the modern operative procedure is not free from risk.[3]

Destruction of Bone in Joints.

1. *Articular Ulcer.*—This is connected with destruction of cartilage. The disorganization may commence in the latter tissue, and thence extend to the subjacent bone. Or the bone may first be involved, and the cartilage suffer secondarily; partly by death, and partly by disintegration. The loss of substance may be more or less extensive; but is seldom great. The symptoms are similar to those of destruction of cartilage. So is the treatment; consisting mainly of rest and counter-irritation. According to the extent and progress of the disease, the cure will be by simple cicatrization, with or without porcellanous formation; or by anchylosis (p. 448).

2. *Articular Caries.*—This more intractable, rapid, and extensive

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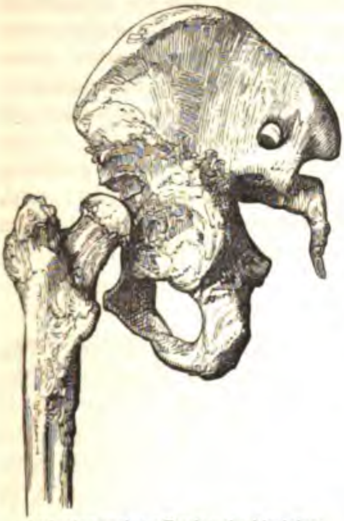
[1] Dublin Quarterly Journal, Feb. 1847, p. 35. [2] Monthly Journal, November, 1852, p. 455.

[3] Monthly Journal, November, 1847, p. 367.

destruction of bone may be either simple, or preceded and accompanied by tubercular deposit. It may originate in disorganization of cartilage; the exposed bone being at first simply ulcerated, and afterwards degenerating into the truly carious condition. Or the original disease may be gelatinous degeneration of the synovial membrane; the articulating ends of the bones becoming carious, on establishment of the suppurative stage. Or the carious state may originate in the cancellated texture; cartilage and synovial membrane becoming secondarily involved. And then there is, usually, the precedence and coexistence of tubercular deposit; the case being one of an obviously scrofulous kind. According to the mode of origin, the symptoms vary; assuming the type of one or other of the affections which have been described in the preceding pages. In fact, this disease may be practically regarded as the advanced stage of the three most formidable affections to which joints are liable: degeneration of the synovial membrane, destruction of cartilage, and suppurative disintegration of the articulating ends of the bones—with or without the scrofulous cachexy.

Fig. 170.



Articular caries affecting the hip-joint.

In the treatment, three results may be looked to; as in ordinary caries. 1. Cure may be, in a great measure, spontaneous. On establishment of the open state of the joint, disintegration advances rapidly;

Fig. 171.

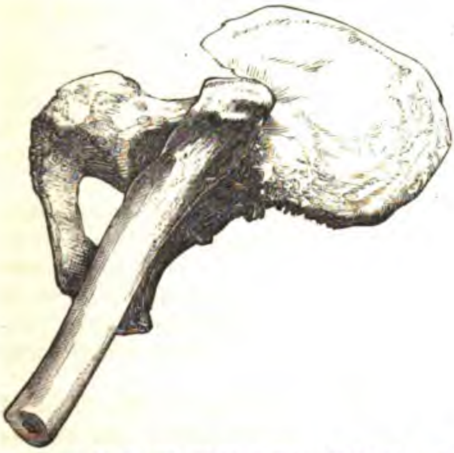


Fig. 172.

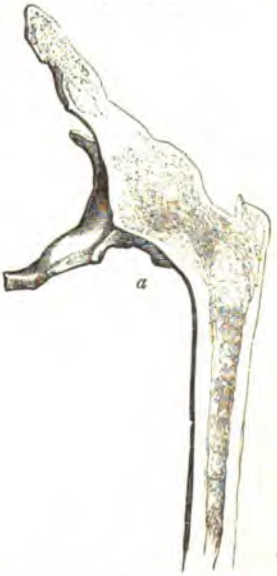


Fig. 171. Cure of morbus coxarius by anchylosis. Fig. 172. The same, bisected, to show continuity of texture.

thereby the carious surface may be wholly destroyed, a tolerably sound part remaining; and on this basis a reparative structure may be reared, sufficient for completion of the cure by anchylosis. 2. Or, the foregoing results being plainly hopeless—yet the disease not being very extensive, the system not greatly depressed by the hectic cause, and the scrofulous cachexy either absent or but slightly and chronically developed—the ordinary treatment for caries may be put in force. The diseased parts may be exposed by incision, and removed; the cure being subsequently either by anchylosis, or by the establishment of false joint, according to circumstances. Such an operation is termed Resection of a joint. 3. Or, neither of the preceding events being practicable, and the frame yielding visibly under hectic, amputation is the only remaining remedy; and, harsh though it be, it is our duty to avail ourselves of it, unless when contraindicated by the circumstances formerly detailed (p. 457).

Resection of Joints.

Articular caries is the disease which demands this operation. The joints most suited to its performance are the elbow and shoulder. The knee and hip seem entitled to claim exemption; especially in the case of disease. But in some forms of external injury, as will afterwards be seen, removal of the head of the femur is far from being an unwarrantable proceeding, and there are also some rare cases of morbus coxarius, in which recourse to resection is by no means unreasonable.[1]

Resection of joints was first proposed and practised, in the end of the last century, by Mr. White of Manchester, Mr. Park of Liverpool, and M. Moreau of Paris. For a time it fell into desuetude. But in the beginning of the present century it was revived by various surgeons; among whom Roux, Hay, and Crampton may be mentioned. And from Mr. Syme it has received such especial impetus, as to place it secure among the regular operations of surgery—and those of the better class too, which save rather than mutilate.

By free incision, the joint is reached; and by cautious dissection, the diseased parts are exposed to their full extent. Then, by the saw, cutting pliers, or both, not only the carious surface is removed, but also the soft, spongy, perhaps infiltrated texture beyond (p. 383). During the dissection for full exposure of the diseased parts, the knife's edge is moved warily in close proximity to the bone; so as to avoid unnecessary injury to the soft parts, especially the arterial and nervous trunks.

The soft parts may be very much altered in structure; dense, pale, and swollen. Yet experience tells us, that it is altogether unnecessary to remove any portion of them. On readjustment of the wound, smart inflammation ensues, pervading its whole track; a fresh and more vigorous suppuration is established; and the altered tissues again change, ultimately coming to form healthy granulations, and otherwise contributing to completion of the cure.

The surgeon, when satisfied that a sufficient amount of the diseased bone, or bones, has been removed, replaces the soft parts; and retains them in contact, by position and bandaging. Adhesion is not to be dreamt of; and accordingly, the treatment need not be directed thereto. Inflammation and suppuration are awaited; and if they threaten to prove excessive, means may be taken for their abatement. The reparative stage having fairly commenced, then an important question comes to be arranged; whether, by occasional motion, the construction of a false joint shall be favored; or whether, by rigid immobility of the parts, secured by careful splints and bandaging, we shall seek for anchylosis. In the majority of cases, in which the operation has been judiciously had recourse to, the former procedure is preferable. Experience has shown that motion, duly employed, is not only capable of inducing the formation of a very useful hinge; at first flexible and weak, but gradually becoming firmer and of greater power; but also, that there is little risk of reinducing disease, by inflammatory accession and its results. When, however, we have operated in a case in which the disposition to relapse is plainly marked, from the state of both part and system, prudence will necessarily dictate the safer procedure which favors anchylosis; sacrificing motion, but retaining the limb, because securing immunity from return of the disease.

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[1] Of late, resection has been applied to the knee-joint more freely than heretofore, by Mr. Fergusson, Mr. Jones, Dr. R. Mackenzie, and others. The result is still *sub judice*. See a paper on the subject by Dr. R. Mackenzie, Monthly Journal, June, 1853, p. 526.

Mr. Syme, to whom the profession is much indebted for his successful exertions in this department of operative surgery, thus describes the condition of the limb, when a fortunate issue has ensued: "It has been proved by numerous facts, that while the joints beyond the disease remain as useful as ever, the one which has undergone the operation regains such a degree of mobility and subjection to the action of its muscles, as sometimes to render it hardly distinguishable from a sound one, and in general prevents it from at all impeding the use of the arm by its stiffness. There is no new joint, strictly speaking, formed; but a strong fibrous substance unites the extremities of the bones, and by its flexibility allows them to move within proper bounds; while the muscles cut across in the operation obtain new attachments, so as to perform their usual office."

In determining on the operation of resection, it should invariably be well considered, whether there be a fair prospect of an issue in all respects prosperous; and but little chance of amputation being ultimately demanded, by reinduction of the disease, probably of an aggravated and acute form. Otherwise, it were better at once to have recourse to the latter operation. A worn system, originally by no means strong, may have power enough to bear up under either resection or amputation; and yet may be certain to give way, under a combination of the two. 1. The patient's age is an important point in such deliberation. For resection, he should be neither very young nor very old; if very young, scrofula is likely to be much concerned in the disease—not of a quiet but of an acute kind, and as it were restlessly active; if old, there may be want of restorative energy in the wound. At the same time, it is to be remembered, that the most favorable cases are those which occur during adolescence; when the elasticity and vigor of youth are on our side; and when, consequently, special success in Nature's plastic efforts may be expected. 2. The system should not be much exhausted; otherwise, reinduction of disease is favored, by want of power, both locally and generally. Besides, it may happen that suppuration in the wound continues to prove excessive, unaccompanied by efficient effort at reparation; and, in consequence, removal of the hectic cause by amputation may be imperatively demanded. The certainty of suppuration, profuse and perhaps protracted, and the chance of amputation following thereon, should never be omitted in our prognostic calculations. 3. By careful examination with the probe, and by manipulation, we should be satisfied that the disease is of no great extent beyond the mere articular extremities. For it is plain that the removal of several inches of each bone—and unless all the diseased part be thoroughly taken away, the operation had better not be attempted—cannot be expected to be followed by even an approach to cure in any way satisfactory; and ought to be superseded by the then not more harsh procedure of amputation. Regarding extensive involvement of the soft parts, we need be less anxious; they being capable of recovery under apparently very adverse circumstances, as already stated. 4. The operation is not to be undertaken during inflammatory excitement, either of the soft parts or of the hard. If such exist, it must first be subdued by the ordinary means (p. 386). 5. Finally, the more intense the development of the scrofulous diathesis, the more unfavorable the case for resection; and *vice versâ.*

Anchylosis.

Stiffness of a joint, as can be readily understood, from what has been stated, may depend on various conditions of the articulation, and of the parts exterior. Accordingly, anchylosis is said to be of different kinds.

1. *Osseous* or *Complete.*—This is the result of ulcer; the osseous texture having been exposed thereby, and subsequently becoming engaged in an energetic effort towards repair. The new osseous formation proves excessive; and the opposing bones become firmly united by incorporation. Or the anchylosis may be in a great measure independent of change in the interior; depending mainly on exuberant ossification on the external aspect. The joint becomes immovably locked in the tight embrace of an outer case of bone, continuous and incorporated with the original tissue; the result of a chronic inflammatory process, of a low grade, and probably connected with rheumatism. Or both forms may be combined; the an-

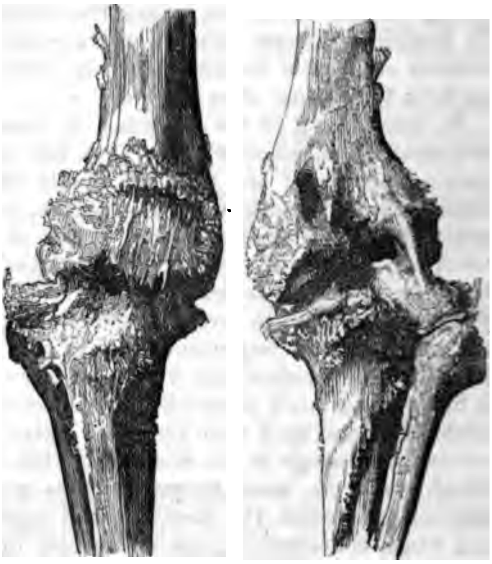

Fig. 173. Fig. 174.

Complete anchylosis of the knee-joint; in different views.

chylosis being general, and at every point complete; and almost all traces of previous articulation having become effaced.

2. *Fibrous.*—The destroyed cartilage is replaced by fibrous tissue, according to the ordinary laws of disease in this texture; and the tissue on the opposing surfaces becomes united, giving rise to almost complete loss of motion. Frequently this form of anchylosis passes into the preceding.

3. *Ligamentous.*—The articular surfaces remain unincorporated at every part; but are kept in close union, and more or less immovable, by alteration in the ligamentous apparatus exterior, which has become condensed, rigid, and non-elastic.

4. *Spurious.*—In this form, there is neither amalgamation of the bones, nor much, if any, structural change of the proper ligaments of the joint. But fibrinous deposit has occurred extensively, exterior to both; the flexor muscles and tendons have become contracted and rigid; and, from this cause, motion is more or less impaired. This state may, or may not be conjoined with synovial disease within the articulation; usually it is.

Treatment of Anchylosis.—In all cases, anchylosis should be warily interfered with. It is an imperfect cure; yet both a saving of the part, and a cessation of morbid progress. And it may be regarded as a compromise between health and disease; the rash infringement of which is most likely to be visited by untoward consequences. The true form is plainly not to be broken up, either by gentle or by violent means. The latter have been made trial of, with a result truly deplorable. A certain M. Louvrier invented an apparatus, by the rude force of which stiff joints might be instantaneously straightened; and patients were submitted to the torture of this "infernal machine." A few escaped with comparative impunity, yet with little improvement in the part; in others, laceration, suppuration, gangrene, delirium, were the results—"accidents frightfully severe, and ordinarily followed by death."[1] The only means of treatment to which true anchylosis is amenable, is that formerly noticed, by section exterior to the obliterated joint, and formation of a false joint thereby; an operation which has been successfully applied to the hip and knee-joints, but in regard to the expediency of which we desiderate a larger experience (p. 455).[2]

Fortunately, the true form of anchylosis is that which most rarely occurs. A joint may seem to be rigidly immovable, by ossification, yet may be altogether free from that form of structural change; and quite capable of a resumed, though it may be diminished function; being, in truth, an example of one of the other forms of the affection. All of these admit of cure. In many cases, function may be wholly restored; in others, the restoration is never complete. In no case should it be attempted, till all active disease has wholly subsided within the joint;

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[1] British and Foreign Medical Review, No. xxiv, p. 552.

[2] The operation alluded to has been performed three times upon the hip, and nine times upon the knee, in America. In one case a fatal result occurred. Obviously the proceeding is by no means devoid of danger; and the circumstances of a case would require to be well considered, as well as urgent, ere such heroic practice be determined on. For details, see a copious note by the learned editor, Dr. Sargent, in the American edition of this work, Philadelphia, 1852.

and even then, the process of cure should invariably be warily and gradually conducted, lest reaccession of disease ensue. The means of restoration are :—passive motion, frequently employed, with all gentleness, and always regulated by the sensations of the patient; friction, with embrocations of a stimulant nature, especially over the extensor muscles; local steam bath; shampooing; and, if need be, division, by subcutaneous section, of the rigid flexor tendons. Splints, bandaging, and other mechanical means, are also often of service, in restoring normal position of the joint; not suddenly, but slowly, and with much caution. And this aid is especially necessary in those cases, by no means few, in which there is not merely flexion of the joint to be undone, but rotation also. Thus, in the knee, as already stated, flexion is seldom great, without rotation outwards of the head of the tibia (p. 451); and unless this be rectified—as can only be done by mechanical means—the cure is obviously incomplete. When tenotomy has been employed, the restorative measures by friction, motion, and machinery, ought never to be had recourse to, until the punctures have fairly healed—a few days usually suffice; otherwise, inflammation and suppuration might readily be induced.

True anchylosis, in which ordinary remedial means are hopeless, may be known; when, in addition to absolute immobility of the joint, even under considerable force, the flexor muscles and tendons are hard, rigid, and at no time, and under no circumstance, show the slightest variation of condition.

The propriety of attention to the position of the joint may be here again urged, in those cases in which the occurrence of complete and irremediable anchylosis is expected; in order that the rigid member may possess its maximum of usefulness (p. 454).

Neuralgia of Joints.

Examples of local irritation (p. 75), in joints, are not unfrequent; in which the inflammatory process is almost wholly in abeyance. The prominent characteristic is pain; unaccompanied by swelling, or other indication of structural change. The affection may be primary; constituting a disease *per se*. Or it may be secondary; merely a symptom of an earlier and more grave disorder. In the knee, for example, we may have nervous pain, either as a symptom of morbus coxarius, or a truly neuralgic affection of that part, independent of disease elsewhere. Although, indeed, the last observation must be made with some reservation; inasmuch as there are found but few cases of neuralgia, in that or any other joint, which are not more or less connected with a perverted state as to structure, function, or both, in some of the internal organs.

Neuralgic affection of the joints is characterized by a class of symptoms sufficiently distinct; a circumstance of much importance, seeing that the appropriate treatment is very different from that which is demanded for structural change. Pain has the ordinary character of the nervous; remittent, intermittent, not slowly and steadily increasing, not constant, not increased by pressure, and not limited to one part, but diffused over the whole of a wide extent of surface. The patient's mind may be diverted from the uneasiness, by conversation, or otherwise engaging the attention; and while the mind is so occupied the pain is really absent. There is no swelling. At least, if there be, it is but trivial in all respects; a mere puffiness, by œdema of the surface; not at all resembling what follows inflammation, in any of the textures of the joint. Motion is well borne; and so is manipulation, even rude; the uneasy sensations are not increased by either. The joint itself may be jarred, pressed, jerked, with impunity; whereas, much complaint may follow pinching of the superimposed integument; that texture, sometimes, seeming to be of greatly increased sensibility. There is no flexion of the joint, as in serious structural change; on the contrary, the limb will very frequently be found extended. The spasms too are wanting, which so commonly attend and invariably aggravate acute inflammatory disease. The patient is obviously out of health; and labors under irritation, general as well as local. But the system is uninvolved in either inflammatory or hectic fever.

This affection occurs more frequently in females than in males. And, usually, the symptoms will be found at least connected, if not caused, by disorder of an internal organ; hysteria; dyspepsia; irritation of the bowels by worms, or by lodgment of other noxious matter. In children, some affections of the joints, apparently neuralgic, would seem to depend on the irritation of dentition.

Treatment is mainly directed towards the general system; restoring normal functions to the uterus, stomach, and intestines, as the circumstances of the case may require. Local applications need be but simple. The serious treatment for structural change would here be not only unnecessary, but certain to prove injurious. Something much lighter is required; such as the endermic use of nitrate of silver, so as merely to blacken the surface. This not only is really efficient towards mitigation of the neuralgia; but also, having an imposing character in the eyes of the patient, is useful by satisfying the mental anxiety, which always attends, and sometimes is not the least prominent of the symptoms. Medicated friction, or fomentation, may also prove of service, in a similar manner. But every stimulus, at all powerful, should be either abstained from, or most cautiously used; inasmuch as the morbid nervous condition of the part may here, as elsewhere, prove but a stepping-stone towards inflammatory accession, entailing serious structural change (p. 77).

The vital importance of a careful diagnosis need not be insisted on. Lest, on the one hand, we treat with unwarrantable severity a comparatively trifling disorder. And, on the other hand, lest we commit the greater error, of supposing a really formidable change of structure in bone, cartilage, or synovial membrane, to be but a nervous affection; and do not discover our mistake, until loss of texture and function has become not only great but wholly irremediable.

Wounds of Joints.

Wounds, penetrating into the more important joints, are invariably to be regarded as among the gravest of injuries; and the danger is by inflammation of the synovial membrane. To the prevention or mitigation of this, treatment is to be directed.

The signs of the accident are not indistinct. The nature of the weapon; the manner and degree of force with which it was applied; the extent, position, and form of the wound; the trickling of synovia, in the form of a viscid fluid, along with the ordinary serous discharge which the wound affords; the presence of a shock to the general nervous system, more or less intense—these, in the great majority of cases, are sufficiently plain indications of the joint having been opened. It is wholly unnecessary to use either the probe or finger, in exploration. Meddlesome surgery is never good; and in no case is it more decidedly bad than here. Many a joint may, under suitable treatment, resist the original injury successfully; but few are able to escape, with impunity, from wound followed by rude, unskilful, unnecessary exploration. The probe and finger are not used here. The eye, aided by the lightest touch, is sufficient.

When the lesion is of the lacerated or bruised kind, inflammation is inevitable. The track of the wound can heal only by granulation, which is invariably preceded by inflammation; and inflammation of one part of the synovial membrane may scarcely be restained from overspreading the whole. All that is in our power, under such circumstances, therefore, is to mitigate what we cannot avert; to keep the process of a low grade, and prevent change of structure.

When the wound is simple and incised, however, the object of our treatment is altogether prophylactic. By absolute rest, rigid antiphlogistic regimen, and the continued application of cold, during the period of incubation; by loss of blood, general and local, timeous and plentiful, so soon as inflammation threatens to supervene; by calomel and opium, antimony, or other selection from the more powerful antiphlogistic remedies—we avert the true inflammatory crisis from both the interior of the joint and the wound's track; so obtaining for the latter union by adhesion. In favor of this result, disuse of suture is advisable; approximation being intrusted to plaster and position. And by that mode of dressing, also, another important indication may be fulfilled—exclusion of atmospheric influence.

The wound, however, may be so extensive as to demand the aid of suture for its coaptation. In this case, the stitches should be as few as possible; and especial care should be taken that they enclose skin alone; the deeper part of the wound's track, and more especially the synovial membrane, remaining untouched.

When inflammation, with suppuration of the synovial membrane, has occurred—as will sometimes be the case, notwithstanding our best care—more or less structural change takes place in that texture. It becomes thickened, infiltrated, and coated by fibrinous exudation; at some parts, it may be broken by ulceration. Ruin of cartilage and bone is not unlikely to follow. Such cases are to be treated on the principles already inculcated for similar disease of a non-traumatic origin (p. 430). The symptoms are certain to prove most urgent. The inflammatory fever will be of the gravest kind; and, in addition to its ordinary signs, great irritability of the stomach is often both prominent and distressing. The swelling, pain, and discharge, will be proportionally great. Yet something like resolution may be effected; all may become quiet, and the joint may recover not only its form, but almost its pristine motion. Or it stiffens, by anchylosis; perhaps irremediably; change of structure having gone so far as to leave no hope of cure, unless by copious plastic exudation from the exposed bone. Or hectic becomes paramount, ere yet destruction of texture has ceased in the joint; and then, to save life, we must sacrifice the limb.

AFFECTIONS OF BURSÆ.

Bursæ are lined by a delicate membrane; closely resembling, both in health and in disease, the synovial investiture of joints. They are of two kinds; the majority being of original and normal formation; a few, adventitious, the result of unwonted pressure, much or habitually applied. They may also be divided into those closely connected with the more important joints; being in truth accessory thereto; and into those which have no such relation, and are altogether insulated. The affections of the latter are comparatively trivial, as regards the ultimate result. Acute inflammation of the former, on the contrary, is always to be regarded with suspicion, and treated with much anxiety and care.

As samples of subcutaneous bursæ, may be mentioned those which enlarge over the knee, in housemaids and shopkeepers; over the insertion of the tendon of the patella, in carpenters; on the elbow, in miners; on the backs of porters and foot-soldiers; on the acromion of those who sustain weight there; on the chin or sternum, in joiners who rest their centre-bits on these parts; on the salient points of club-feet; on the hump of hunchbacks; and on the outer malleoli of tailors.

Bursitis.

This may be either acute or chronic. The *Acute* form is usually the result of external violence, of exposure to cold, or of both these causes. The symptoms and results resemble those of synovitis. There is enlargement of the bursal cavity, by distension; the secreted fluid being at first serous, then sero-purulent, and ultimately purulent, according to the progress of the inflammatory process. The tumor is distinctly fluctuating, and very painful to the touch. There is acute œdema of the superimposed and surrounding areolar tissue; the skin is red and tender; and, not unfrequently, smart erysipelas coexists with the deeper inflammation. The lining membrane becomes successively congested, turgid, infiltrated, increased in vascularity, and coated by fibrinous exudation; ultimately it ulcerates, the contents escaping towards the surface.

Treatment consists, in the first instance, of ordinary antiphlogistic means—as rest, leeches, fomentation, aconite, antimony—with a view to restrain the inflammatory process. If successful, the serous fluid soon disappears by absorption; as acute dropsy usually does, on subsidence of the affection by which it was produced. If it linger, slight discutients will be sufficient to complete its dispersion. When, however, resolution has not been effected, and suppuration has occurred, we need have no hesitation in treating the case as an ordinary acute abscess; by free, early, and direct incision. Temporary aggravation of the inflammation may follow infliction of the wound; it is met in the ordinary way; and, on its subsidence, healthy granulation will, under suitable treatment, advance towards satisfactory cicatrization—the cavity becoming obliterated.

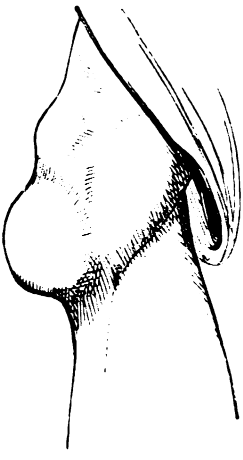
When the bursa is in connection with, or even merely in the vicinity of an important articulation, our antiphlogistic efforts must be doubly energetic and anxious; to avert, if possible, involvement of the more important part. And when suppuration has occurred in such a bursa, incision should invariably be both early and free.

Chronic Bursitis, a very common result of moderate and habitual pressure, produces a slowly increasing swelling, dull, and almost painless; without either superficial œdema, or redness of integument. The contents are usually thin and clear.

Treatment consists chiefly in abstraction of the cause, and in the employment of discutients; as blisters; mercurial plaster, or equal parts of the gum and mercurial plasters; iodine, in form of ointment, or of strong solution; gentle support, by bandaging. Such means prove successful, when patiently and duly employed, in the great majority of cases. Should they fail, then the treatment may be as for hydrocele; drawing off the fluid by a trocar, and injecting a small quantity of the solution of iodine. Acute œdema is produced; active congestion soon subsiding, its serum is quickly absorbed; and, the balance of health having somehow been struck, reaccumulation does not occur (p. 171).

Sometimes the cyst of the bursa becomes thick, indurated, and otherwise altered in structure. In such cases, resolution is not complete; more or less hardness and swelling continue, in spite of the most active and persevering discutient treatment. Unless the symptoms prove unusually troublesome, however, severer remedies—as by excision—are scarcely warrantable.

Fig. 175.



Enlarged bursa over the patella; the result of pressure. Housemaid's knee.

Sometimes, not only is the cyst much thickened; the interior is also filled by a fibrinous deposit, partially organized. Such a state is obviously not amenable to discussion; and may be safely treated as an ordinary tumor, by excision.

Sometimes, the cyst slowly suppurates. The chronic abscess may perhaps be discussed; more probably, it reaches the surface and is discharged. Even free incision may not be followed by satisfactory closure; an indolent purulent pouch remaining, filled only by ill-formed pus; and granulation proving sadly deficient. In such circumstances, the temporary application of a seton is advisable; to rouse the part to the required degree of sthenic effort.

Small adventitious bursæ not unfrequently open by suppuration; and then remain open; continuing to discharge a thin fluid, partly bursal, partly purulent, through an irritable sinus, which terminates in a more irritable ulcer—as in open *Bunion*. The best mode of getting rid of such troublesome affections, is to insert a pointed piece of potassa fusa; applying it freely to the whole of the secreting surface. A slough is formed, including the adventitious structure; and, on its separation, healthy granulation and closure will ordinarily follow.

Small adventitious bursæ may be chronically enlarged, and be themselves the seat of little pain or uneasiness; while from a red, glazed, and intensely irritable state of superimposed skin, the patient may from time to time endure extreme suffering—as in the slighter form of bunion. In such cases, total abstraction of pressure, and the application of nitrate of silver, so as merely to blacken and desiccate, will generally suffice to restore a state of indolence and quietude.

Loose Bodies.

These are sometimes found in bursæ. If troublesome, they may be removed. By direct incision, if the bursa be insulated and small; by subintegumental puncture, and secondary excision, when the bursa is large, or connected with a joint.

AFFECTIONS OF THECÆ.

Thecitis.

The thecæ of tendons may be acutely affected by the inflammatory process; from rheumatism, or in consequence of external violence. More frequently, the process is chronic; the slow, and perhaps remote consequence of a blow or strain. A fluctuating swelling forms, with little pain; but with a marked feeling of uneasiness, as well as of weakness in the part; the play of muscles, tendons, and sometimes of the neighboring joint, being manifestly impeded.

Treatment is by rest, pressure, and discutients. If the rheumatic diathesis be present, the ordinary remedies—as colchicum, iodide of potassium, &c.,—are of course to be employed.

Loose Bodies.

These are much more frequently found in thecal than in bursal cavities. They are seldom single; and may be very numerous. Commonly, they are of uniform appearance and size, like barley-corns or melon seeds; of much softer consistence than the analogous formations in joints; most common at the wrist and shoulder, especially in the former situation; floating in a thick, glairy, but clear fluid; and causing much inconvenience by swelling. On manipulation, during slight motion of the part, a characteristic crackling and grating are imparted to both touch and ear.

Removal by direct incision will certainly be followed by intense inflammation. Suppuration, with much constitutional disturbance, can hardly be avoided; and it is probable that, on ultimate subsidence of the inflammatory process, much change of structure will be found to remain;
ing the function of the part more seriously than did the previous
g. Such loose substances, therefore, should not be interfered with
tion, unless when especially troublesome; and then th

taneous and valvular method of incision will probably be most expedient. Nor, when numerous, should an attempt be made to remove them all at once; otherwise atmospheric entrance is likely to take place, bringing on the dreaded inflammation. By repeated punctures, however, they may at different times be safely extruded. Should inflammation and suppuration unfortunately occur, we must unhesitatingly make a free and direct incision; braving the worst.

In the wrist, Mr. Syme practises free and direct incision; taking care to divide the annular ligament; in the belief that thus tension cannot occur, and serious inflammatory results will be avoided.[1] In France, tapping the part, with subsequent injection of iodine, is practised; as for hydrocele.

Ganglion.

This term is often applied to the diffuse chronic collections in thecæ. But, perhaps, it is more correctly limited to the distinct, circumscribed, and prominent, though small collections, which so frequently occur at the wrist and ankle, particularly in the former situation. The cyst is thin and translucent; the contents are synovial; and the swelling, though tense, distinctly fluctuates. Sometimes no cause can be assigned; in other cases, the origin is attributed to a strain. Females are more frequently affected than males. Mere deformity may be the result; or there may also be weakness, with occasional pain.

The indication of cure is very simple; to extrude the synovial contents from the interior of the cyst, to disperse them into the surrounding areolar tissue, and to promote their gradual removal thence by absorption. For this purpose, it is necessary to make an aperture in the cyst. If the formation be recent, pressure will be sufficient. The thumb, or thumbs, being applied energetically to the part, the cyst is felt to give way; the tumor collapses; by pressure and friction continued, the contents are completely expelled; and then moderate pressure is maintained, by compress and bandage, to prevent reaccumulation, while occasional smart friction is also used to favor absorption. If thumbs fail, the part may be struck by any hard substance. Or, what is better, a fine needle, such as used for the eye, may be introduced at one or more points, to puncture instead of rupturing the cyst; the instrument being cautiously withdrawn so as to prevent the entrance of air.

On Affections of the Joints, see Cooper, on Diseases of Joints, Lond. 1807; Ford on Disease of the Hip-joint, Lond. 1810; Lloyd, on Scrofula, Lond. 1821; Brodie, on Diseases of Joints, Lond. 1822;—5th edition, 1850; Barton, North American Med. and Surg. Journal, April, 1827; Scott, on the Treatment of Diseased Joints, Lond. 1828; Wickham, on Diseases of the Joints, Winchester, 1833; Key, on the Ulcerative Process in Joints, Med. Chir. Trans. vols. xviii, and xix, 1833; Coulson, on Diseases of the Hip joint, Lond. 1837; Velpeau, Leçons Orales de Clinique Chirur. vol. ii; Louvrier, Dict. des Dict. de Médecine, vol. i, Paris, 1840; Toynbee, on Cartilage, &c., Phil. Trans. Lond. 1841; Goodsir, Anatomical and Pathological Observations, Edin. 1845; Redfern, Monthly Journal, 1849, pp. 967, 1065, 1112, 1275; Coulson, on Subcutaneous Bursæ, Lancet, No. 1424, p. 666; On the Intimate Structure of Articular Cartilages, by Joseph Leidy, Amer. Jour. of Med. Sc. April, 1849; R. W. Smith, on Chronic Arthritis of the Hip-joint, in his Treatise on Fracture, Dublin, 1850.

On Excision of the Joints, see White's Cases in Surgery, Lond. 1770; Park, A New Method of Treating Diseases of the Knee and Elbow, Lond. 1733; Moreau, Resection des Articulations, &c., Paris, 1803; Roux, de la Resection des Portions d'os Malades, &c., Paris, 1812; Crampton, Dubl. Hosp. Reports, vol. iv, 1827; Velpeau, Nouv. Elem. de Med. Operat. tom. i; Syme, on Excision of Joints, Edin. 1831.

CHAPTER XIV.

DISEASES OF THE ARTERIES.

ARTERITIS.

THIS term denotes the inflammatory process affecting the arterial tissue; as usual, whether or not such process be above or below the standard of true inflammation. It may be either acute or chronic.

Acute Arteritis.

The acute form may be limited to one portion of an artery; or it may be of a spreading kind, as in the venous tissue.

1. *The Spreading.*—This is of comparatively rare occurrence; and by some its existence is even doubted. The patient is usually beyond the middle age, and of broken constitution. The disease is seldom limited to one vessel, but pervades a large portion, or even the whole of the arterial system of the part affected. The limbs, especially the lower, are the parts most frequently involved. The symptoms are obscure, and apt to be mistaken for those of rheumatism. There is much constitutional disturbance, as can readily be understood, of a febrile kind; but not showing the usual sthenic signs of true inflammatory fever; partaking more of the irritative type. The tracks of the main vessels affected are painful; and pain is increased by pressure and motion; induration, too, is felt; the pulse is feeble, and has a peculiar thrilling stroke; its impulse gradually diminishes, and ultimately it wholly ceases in the part. The superimposed soft textures are seldom involved; the skin remaining pale and otherwise normal in its appearance. The effects on the arterial coats are turgescence and infiltration, with loss of the smooth serous character of the internal surface; the contents become coagulated, and adherent to the changed tube; ultimately the canal is wholly occluded. In proportion to the obstruction of circulation, which necessarily results from the progress of such change, vital power in the parts affected is very much impaired; both temperature and sensation are diminished; and should stimulat [redacted] be unwisely adopted to restore these, excitement beyond t ntrol is almost certain to be induced, and gangrene foll f the obstruction be both complete and general in a ll surely happen, as the direct result; a simple cessat out intervention of the attempted inflammatory proce hand, in slighter cases, the original affec-

tion may subside, ere yet consolidation has been complete; the obstructing coagulum may be gradually removed, and circulation with vital power restored.

The treatment of such disorder, when detected, probably comes better within the department of the physician than of the surgeon. It will consist of leeching along the affected course, rest, and ordinary antiphlogistics. A tolerably free administration of calomel and opium may also be desirable, to prevent consolidation if possible. Opium, after depletion, will in all cases be suitable; not only as relieving pain, often severe, but likewise tending to maintain tone of the arterial system. Subsequently to the occurrence of obstruction, a mild mercurial course may be given, or other sorbefacients em[illegible]ile mercurial ointment may be applied over the affected tru[illegible] view to gradual removal of the obstructing coagulum. But all stimu[illegible]ing applications, whether external or internal, more especially the former, must be used with the greatest possible caution; lest the untoward result of excitement exceeding power be induced. When obstruction has become confirmed, the principal care had better be directed to the avoidance of all stimuli, whereby such excess might be occasioned.

By some it is believed that an especially acute and spreading form of arteritis sometimes though very rarely occurs, analogous in its character to the worst kind of phlebitis. It commences in a part, but tends to involve the whole system. The true inflammatory crisis is reached, ere coagulation has occurred; purulent matter, consequently, when secreted from the internal coat, mingles with the circulating stream; and, carried through the system, has the same poisonous effect as in diffuse suppurative phlebitis. Pyaemia is established. First, irritative fever attends; but, on occurrence of the direct purulent admixture, this is merged wholly in typhoid symptoms of the most urgent kind, under which the patient rapidly sinks. Should he struggle on for some time, gangrene ensues; and probably occurs at more points than one. In such a disease, it is plain that hope from treatment can only be entertained at the outset. This period, therefore, should be occupied in the use of our most active and powerful antiphlogistics. On the suppurative crisis having been reached, lowering treatment must pass into that of support; but with scarcely a hope of successful issue.

2. *Chronic Arteritis.*—This is a very common result of external injury done to the tissues; as by wound, or by application of ligature. Various results may ensue, corresponding to the amount of the inflammatory process induced. The minor grades will give exemplification of a [illegible] as we [illegible] after ligature. The coats become [illegible] condensed, as the part [illegible] truly inflammatory, gives [illegible] a result which we do [illegible] to avoid, in opera[illegible] almost certain to follow. [illegible] with circumstances [illegible] gangrene of the vessel: [illegible] of an artery which

coats have been too rudely manipulated, and too extensively separated from their areolar connections.

The treatment of this form of arteritis consists in the employment of ordinary mild antiphlogistics, chiefly local; and so conducting our direct interference with the vessel, that the minor grade of the inflammatory process only shall be obtained, whose characteristic is plastic exudation, with obliteration of the canal at the affected point.

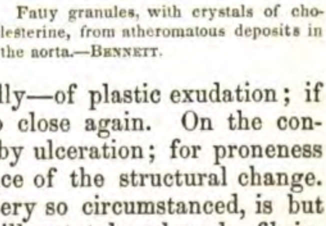
Chronic Arteritis.

This is of infinitely more frequent occurrence than the acute; and usually idiopathic. It seldom occurs till after the middle period of life; is more frequent in males than in females; and its accession would seem to be much favored by a shattered state of constitution; more especially when this arises from intemperance, venereal infection, or abuse of mercury. It is frequently associated with hypertrophy of the left ventricle of the heart.

Acute arteritis may be said to be chiefly connected with injury of the arterial tissue; the chronic, with its disease.

Chronic arteritis is gradual and insidious in its progress; scarcely marked by pathognomonic symptoms; and seldom discovered during life, but by its ulterior results—abnormal dilatation of the artery, and formation of true aneurism. The structural change, however, is sufficiently marked. It may affect an artery throughout its whole extent, continuously; or it may occur only in patches; and such patches are usually situate in the vicinity of bifurcations, or at the origins of large arterial branches. The internal coat is thickened, spongy, and less smooth, and serous in its surface. Between this and the middle coat—in the intermediate tissue which is sometimes termed the sclerous coat—deposit takes place of a soft caseous-looking substance, in granules or patches; usually termed *atheromatous*, and, according to recent researches, composed of fatty granules and molecules, in some cases associated with crystals of cholesterine. Not unfrequently the middle coat too is altered; becoming thin, yellow, and opaque. In consequence of such change, the arterial tissue is found to have its elasticity much impaired; it will not accommodate itself to the play of extreme motion, as before. Its cohesion is diminished; if forcibly stretched, it is apt to tear, especially in its inner coat. It is incapable—comparatively, sometimes actually—of plastic exudation; if a tear do take place, it is not likely soon to close again. On the contrary, the breach is more likely to widen by ulceration; for proneness to that morbid result is another consequence of the structural change. Hence it will at once appear, how an artery so circumstanced, is but little amenable to deligation. Occlusion will not take place by fibrinous exudation of a suitable kind; by ulceration, the unobstructed canal

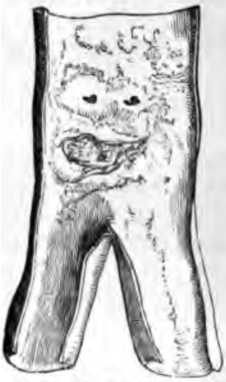
Fig. 176.



Fatty granules, with crystals of cholesterine, from atheromatous deposits in the aorta.—BENNETT.

will be opened into; and dangerous hemorrhage necessarily ensues. It is also equally plain how the occurrence of aneurism is favored; by the proneness to ulceration; and by the impairment of elasticity, cohesion, and plastic power. Dilatation, rupture of the internal coat, non-repair of the breach, on the contrary its extension, are obviously rendered liable and likely.

Fig. 177.



Arterial degeneration of the aorta, above its bifurcation. Ulceration in progress.

Calcareous degeneration may follow or accompany the state just described. Frequently, however, it is the concomitant and result of old age. As the arcus senilis forms on the cornea, as the body ber [illegible] rostate enlarges, as the teeth drop out, a [illegible] rtilages ossify, so the arterial tubes are liable to become hard and non-elastic, by deposit of earthy matter between the internal and middle coats; sometimes in granules, more frequently in scaly patches, sometimes in continuous masses. The internal coat is dry and shrivelled in appearance; sometimes loose and almost villous in its surface; sometimes torn, shrivelled, and raggedly projecting; not unfrequently the calcareous scales are incorporated with it. Very often atheromatous deposit may be seen mingled in greater or less proportion with the calcareous, in the artery of the old man. And sometimes a few calcareous scales may be found among atheromatous deposit, in the artery of the man of middle age. The calcareous deposit is ordinarily termed ossification; but the hard substance is altogether different from bone; devoid of stroma, of fibrous arrangement, and of vascularity. Sometimes it is so extensive as almost to banish all trace of the original structure of the vessel, converting it into a rigid earthy tube.

This state, also, must obviously interfere with the elasticity and plastic power of the tissue. Yet aneurism much more seldom follows upon this than on the atheromatous change. It is probable that cohesion is less impaired, and ulceration less liable. Also it is plain that, in consequence of this earthy change occurring only in advanced age, when muscular effort is much less sudden and extreme than in younger years, one of the most common exciting causes of aneurism is not likely to be in operation. Calcareous degeneration seldom occurs, to any extent, before sixty years of age. But the period of proneness to aneurism is found to range between the ages of thirty and fifty—the period of muscular exertion, exposure to hard living, and liability to atheromatous degeneration of the arterial coats.

Both forms of degeneration may be said to be limited to the aortic system. The pulmonary is almost wholly exempt.

For calcareous degeneration we can do nothing. When the atheromatous is suspected, all stimuli should be abstracted, the diet carefully and temperately regulated; sudden and great muscular exertion should also be avoided, as well as mental excitement or other causes likely to occasion acceleration of the sanguineous flow. If the rheumatic diathesis be present, or the system have suffered by syphilis or mercury, means m be taken to counteract the cachexy. If need be, the force and rapidity of circulation may be farther controlled, by digitalis, aconite, or other sedatives on the heart's action.

Aneurism.

By this term is meant a pulsating tumor; composed of a cyst, which is filled with blood, partly fluid, partly coagulated, and whose cavity communicates with the arterial canal.

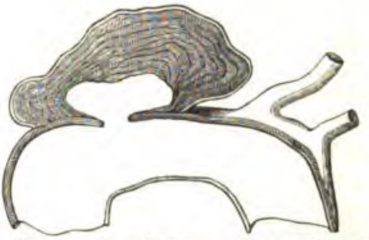
Various divisions have been made of this important subject. The most ordinary, as well as most useful, is into the *True* and *False*. And to these terms it is essential that definite meanings be attached. Various interpretations are given by different authors; and let us not therefore be blamed, if we attach our own. So here let it be understood, that by true aneurisms we mean those which are the result of disease from within; the tumor being formed by dilatation, or by rupture of the coats; or by their ulceration from within, or by a combination of these circumstances; and the cyst consisting of one or more of the arterial coats, yet unbroken. By the term false, on the contrary, we shall denote those aneurisms in which the arterial tunics form no part of the aneurismal cyst, having been wholly divided, either by wound or by ulceration from without. These latter constitute the minority of the cases of aneurism.

True Aneurism.

The mode of formation may vary. 1. *By Dilatation.*—This is most frequent in the aorta. The coats do not give way, either by rupture or by ulceration, but evenly dilate into a pouch of greater or less volume; in the parietes of which atheromatous deposit is apparent, and the continuity and integrity of the tunics can be distinctly traced—more especially after maceration. The dilatation may be partial, on one aspect of the canal; and the hollow swelling which results is said to be Sacciform. Or the whole tube gradually dilates, and gradually recovers, giving rise to a spindle-shaped enlargement, which is termed Fusiform. Or the general dilatation may be abrupt and in all respects uniform; it is then said to be Cylindroid.

2. *By Dilatation and Rupture.*—In this form, commencement of the tumor and abnormal cavity is made by dilatation of all the coats. Then the internal gives way, either by ulceration, or by tearing during some sudden muscular exertion; the middle coat usually yields at the same time; blood in consequence becomes insinuated into the aperture; the external coat yields before the pressure from within, and, expanding, forms the true aneurismal cyst. This new cavity is filled by fluid blood; and, under the impulse thence received, the cyst gradually enlarges; receiving

Fig. 178.



True aneurism of the aorta. The greater part of the cyst filled with clot. Aperture of communication small.

strength and addition both from without and from within. From within, by deposit of fibrin from the blood; from without, by condensation and incorporation of the surrounding tissues. By condensation and organization of part of the fibrin from within, with deposit also from the living texture, the interior of the cyst may come to be lined with a quasi-membranous structure; analogous to, and often apparently continuous with the internal coat of the artery. This, however, will only be apparent at those points where there is no agglutination of the fibrinous clot, and where no recent fibrinous deposit has taken place. Resistance to enlargement of the tumor is made partly by the strengthening of the cyst, partly by the contractile effort of repression exerted by the surrounding tissues.

The first part of the process of formation is gradual and slow. But on giving way of the coats, increase is sudden and considerable, and for a time rapid; often the patient has, by sensation in the part, a distinct perception of the event. This is the most frequent form of aneurism.

3. *By Rupture.*—This kind of tumor forms rapidly from the first; and may in but a short time attain a large size. The immediate or exciting cause is sudden muscular exertion, as in pulling, leaping, &c., whereby the arterial tunics are stretched beyond what they are able to bear. The internal and middle coats give way at once, by laceration; and aneurismal formation speedily follows. The patient has generally a distinct perception of the tear, and consequently of the very first origin of the tumor. Sometimes the event occurs during ordinary exertion of walking; then he is apt to suppose that he has been struck on the part by a stick or stone. But this exciting cause is not alone sufficient; there must be a predisposing one also; and that is the atheromatous degeneration. Were it not for this, the tear might simply heal; or, at all events, fibrinous exudation would take place of a plastic kind, and thereby the arterial tube would be obliterated; either way, there would be no aneurism. But when arterial degeneration exists, no such plasma is afforded, no such reparative effort can be made; on the contrary, the tear widens by ulceration, and the aneurismal formation advances.

Varieties.

1. *Dissecting.*—An aneurism is termed Dissecting, when the arterial tunics are more or less separated from each other by the blood's infiltration. The external coat alone may be detached from the middle and internal. Much more frequently, however, the transverse fibres of the middle coat are separated into two layers, for a greater or less distance, in the track of the vessel.[1] Also, the dissection may be either complete or partial. That is, the hiatus between the coats may terminate in a blind sac, where blood stagnates, or whence rather it will regurgitate. Or it may be complete; there being a second aperture of communication with the artery, at the extremity of the hiatus,

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[1] For most practical purposes, it is enough to regard the arterial tissue as consisting of three layers—internal or serous, middle or fibrous, and external or areolar. But microscopically, the number of layers may be much greater. The following layers have been recognized by Henlé—1. The epithelial. 2. The striated, or fenestrated membrane. 3. The longitudinal fibrous. 4. The circular fibrous. 5. The yellow fibrous, or elastic. 6. The areolar.

through which the stray current of blood again joins the main stream. Such dissections may be of slight extent, or they may occupy several inches of the vessel. The variety is of comparatively rare occurrence; and is seldom found affecting any artery except the aorta.

2. *The inner coat alone may remain entire.*—The external and middle have given way; and the cyst is formed in the first instance, by the dilated internal coat alone. In true aneurism, this condition is rare. It has been observed by Breschet, Dubois, Dupuytren, and others; probably the result of ulcerative destruction of the other tunics, from without.

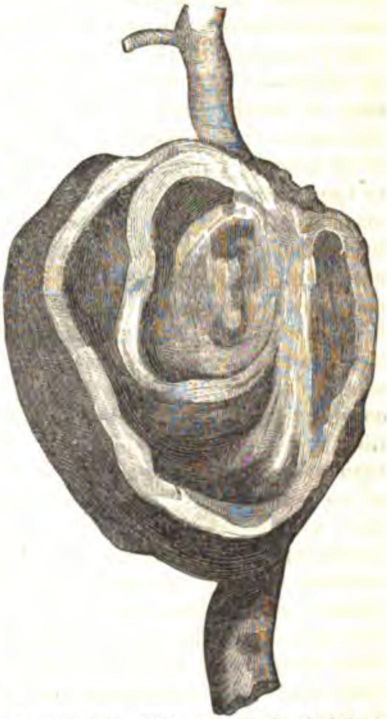
3. *The inner and external coats have both been found entire;* the middle alone having given way.

4. It is useful to remember that aneurism is sometimes connected with the artery by means of a *narrow neck* of considerable extent, instead of the abnormal cavity being bluffly set upon the normal tube. The fundus of the pulsating tumor may consequently project several inches from its arterial origin; and, in certain situations, as at the root of the neck, diagnosis is thence rendered obscure. An aneurism may seem to be of the innominata, or of the first third of the subclavian, while in truth it is of the aorta. Such a tumor is said to be *Pedunculated.*

Aneurism is also said to be *Limited* or *Diffuse.* In the one case it is bound within the limits of a proper cyst; in the other, having either burst through this, or been originally devoid of it, blood is widely diffused by infiltration into the surrounding tissues.

The true aneurism is at first invariably limited. It may become diffuse by giving way of the cyst, from ulceration or otherwise. The occurrence is always secondary. In false aneurism, on the contrary, the form may be diffuse or not at first, according to circumstances. If the escape of blood be sudden, great, and violent, no distinct restraining cyst can form; infiltration is wide and free; the diffuse variety is at once established. Or a cyst may have formed, and subsequently given way; and then, as in the true form, the occurrence is secondary. As will be seen, supervention of the diffuse condition is sometimes salutary; more frequently pernicious.

Fig. 179.



Aneurism, of a double cyst. The first had given way; the tumor then became diffuse; but a second cyst formed, of non-arterial tissue.—Sir C. Bell.

False Aneurism.

In this form, as already stated, the aneurismal cyst is not composed of any of the arterial coats, but entirely constructed from the tissues exterior and adjoining to the vessel. 1. Most frequently, it is the result of wound; all the coats being at once perforated; blood escaping in considerable volume and force, and thereby condensing for itself a cyst; the cyst subsequently becoming strengthened, yet dilating in the ordinary way. 2. Or it may be the result of laceration; as in severe fracture of a limb. Or it may occur independently of fracture; as by the employment of undue force in reducing dislocation. The main artery is torn, either partially c ly. Profuse hemorrhage is the result; infiltrating the neighb t parts, or perhaps distending them to form a large bloody pool; and the arterial aperture does not heal by fibrinous occlusion, but remaining patent, establishes a permanent communication. The diffuse form of aneurism is thus at once produced. Or the occurrence may be secondary. At first, the artery is only bruised; it sloughs, or ulcerates; and then, pouring out its blood—it may be several days subsequently to the injury—the aneurism is established. 3. Or the arterial coats may be perforated by ulceration from without. An abscess forms in the immediate vicinity of an arterial trunk. Evacuation is delayed; and spontaneous approach to the surface is repressed by fibrous investments. The cavity of the abscess enlarges deeply, and compresses the arterial tissue. This at first bends before the pressure, and is besides protected by fibrinous exudation, which seems as if specially provided. By and by the arterial tube may come to traverse the cavity of the abscess; enlargement having occurred on its every side. Pressure is great and constant; the arterial connections are weakened or altogether removed by a dissecting action of the confined pus; and under the combined effect of constant and steady pressure, with diminished power of control, ulceration is ultimately established. The arterial canal becomes continuous with the cavity of the abscess, through an ulcerated aperture, perhaps of no great size. The cavity, formerly filled with pus, becomes occupied by blood; what was an abscess, has become a variety of false aneurism. One obvious advantage of the narrow aperture of communication is, that the pus is gradually, and not at once, brought into the general circulation—for a time, probably, continuing to whirl in turbulent motion within its own cyst; and thus the system may be saved from those formidable typhoid symptoms, which usually follow any considerable and direct admixture of pus with the circulating mass of blood. A memorable example of this form of the disease was afforded by the hospital experience of Mr. Liston (p. 187).

Lately a case occurred in my hospital practice, which seems to bear strongly on the point. A woman was stabbed in the arm, by means of a blunt knife, and lost much blood at the time. About eight days afterwards, the wound being in an ulcerating state, serious hemorrhage occurred; and, cutting into the part, I secured two bleeding arterial points by ligature. After this, the wound healed kindly though slowly *from the bottom;* and the woman was discharged with a *firm, depressed cicatrix.*

About a fortnight afterwards, however, she returned with a large false aneurism occupying the whole of the upper part of the arm, and restrained from bursting only by the thin translucent pellicle of the cicatrix. Through this the dark interior could be plainly seen. No time was to be lost; and the ordinary direct operation was performed, with a successful issue—the ulnar artery being found open, about an inch below where the ligature had been applied in the first instance. The woman, it seems, had resumed laborious occupation immediately after dismissal; and very speedily a throbbing was felt in the arm, such as is usually thought symptomatic of suppuration. She believed that matter had formed, and that it would follow the ordinary course of an abscess; but became alarmed by afterwards observing a general pulsation of the arm, and on account of this she once more sought hospital relief. Such a history seems to point to suppuration and subsequent arterial communication with the abscess, as the sequence towards this aneurismal development.

The most common example of false aneurism, is that which follows accidental wound in venesection, at the bend of the arm. The mistake is usually at once discovered, and means taken to avert the consequences; by energetic and direct pressure on the part. Blood in consequence escapes but slowly from the wound in the artery. By the pressure, it is prevented from being discharged externally. It slowly accumulates in the areolar tissue, exterior to the artery, and beneath the fascia of the forearm. This tissue becomes condensed into the form of a cyst; which, as in true aneurism, receives corroborating addition both by deposit from the blood, and by amalgamation of other tissues on its exterior. The internal additions come to assume a regular form, where incorporated with the original cyst; they become fully organized, and, acquiring a compact structure, constitute a lining membrane, smooth, and somewhat of a serous character; often seeming, as in true aneurism, to be continuous with, and not very dissimilar to, the internal coat of the artery. The cyst may ultimately give way, and the aneurism become diffuse; but this is by no means probable, seeing that the cyst is powerfully strengthened by the investing fascia of the forearm. Or, when remedial pressure is either absent or imperfect, the bloody swelling may be large and diffuse from the first. The coagulum is seldom dense throughout, in either the diffuse or the circumscribed variety; but often has a central space or canal, continuous with the arterial aperture. In recent cases, treated by incision, this circumstance may be of some practical interest; facilitating exposure of the bleeding point.

By some it is supposed that the aneurismal formation is different from that just described. That the escape of blood, with formation of an exterior cyst, is not immediate; but that the aperture in the vessel is first filled up by a membranous formation; and that this, yielding before the blood's impulse from within, gradually dilates and forms the aneurismal sac. False aneurism may in this way be produced; but it is probable that such a mode of formation is comparatively rare, forming the exception rather than the rule.

However formed, the false aneurism has one very important practical point in its nature; namely, its formation being independent of arterial degeneration. In consequence, we have it in our power to apply a remedial ligature in the immediate vicinity of the tumor; naturally expecting to find the arterial tunics as sound there as at any other part.

Symptoms of True Circumscribed Aneurism.

This being by much the most frequent form of aneurism, its symptoms may be regarded as descriptive of the disease in general. We are also to be understood as referring to aneurisms which are external to the great cavities of the body, and consequently amenable to surgical treatment.

There is a swelling, at first small, but gradually increasing; originally soft and quite compressible, the cyst being as yet filled only with fluid blood; ultimately hard, and incapable of being made altogether to recede, its interior having become occupied by a greater or less amount of solid coagulum. But however great the diminution, or however complete the disappearance may have been under pressure—so soon as this is removed, there is an immediate and forcible return to the former dimensions. In the tumor there is distinct pulsation, from the beginning; appreciable by both sight and touch, but more especially by the latter; synchronous with the heart's impulse; equally felt in all aspects of the tumor; increased by pressure on the distal side; diminished, or perhaps wholly arrested, by pressure on the cardiac side of the tumor. At each impulse, there is not only elevation of the tumor, but distinct expansion of it at every point. The more firm the pressure applied, the more distinct the impulse, and the more evident the simultaneous effort of enlargement. At the same time, a very expressive thrill is imparted to the compressing hand; and if the ear be applied, mediately or immediately, a *bruit de soufflet* will be heard more or less distinct. The bruit, however, it is important to remember, is not an infallible indication of the presence of aneurism. Pressure on the artery, by the stethoscope, or by any tumor, may induce it; and it is also found when no structural change at all exists, seeming to depend on an impoverished and deficient state of the blood.

The tumor's growth is steady; seldom so rapid as the outward bulging of an abscess; seldom so tardy as the enlargement of any solid tumor, not malignant. Pain is complained of; not so much on account of structural changes in the artery itself, as in consequence of subsequent interference with the adjoining textures, as the enlarging tumor encroaches on them. And sometimes in what may be termed acute aneurisms, the suffering is really excruciating. Lately, a patient under my care in the hospital, affected with acute inguinal aneurism, expressed himself as enduring constant agony in the thigh and knee; and urgently demanded relief by operation. This was delayed, in the hope of finding both part and system in a more favorable condition, after suitable treatment. But meanwhile, the poor man, in a mingled frenzy of delirium and despair, committed suicide by thrusting a corkscrew into the centre of the tumor.

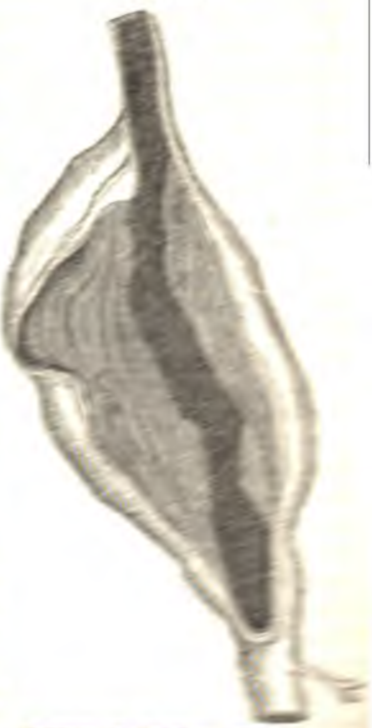
Pressure on the passing nerves causes not only pain but numbness also of the lower part of the limb. By pressure on the veins and lymphatics passive congestion is induced; causing more or less œdema, by which the limb is swollen and discolored. From the same cause there is physical weakness, diminution of temperature, and impairment of function. And let it never be forgotten, that vital power—the power of resisting or controlling vascular excitement, and averting its untoward results—is very much impaired.

Important organs in the neighborhood may have their functions seriously impeded by the bulging of an aneurism; compression of the air-passages may threaten asphyxia; inanition may be impending, by obstruction of the gullet.

The patient's own perception of the disease is usually most distinct. He sees and feels the living, beating tumor. But the period at which he first becomes aware of its presence is very various. If it have been formed by dilatation only, weeks or months may have elapsed, subsequently to its origin, ere it arrests his attention. If it have been produced by the second mode of formation, the first stage, by dilatation, may have passed unnoticed; but the aggravation by giving way of the coats is usually quite distinct. And, as already stated, when the disease has begun by sudden laceration of the tissue, the very instant of origin is noted and remembered by the patient.

As the tumor enlarges, the artery contracts on its distal aspect, and circulation is weaker there. Did the lower limb depend for its arterial supply wholly on the contents of the affected trunk, vital power would be brought much lower than it is. But the diminished volume of the main stream is compensated, by enlargement of the side channels. What is termed the collateral circulation—at all times existing—is amplified to atone for the deficiency. Collateral branches, arising above the tumor, enlarge; and passing round the aneurism, pour their increased contents again into the main trunk. Some inches beyond the tumor, the arterial canal again shows its normal dimensions; and the circulation is ultimately the same; only, at and around the tumor, it is partly direct and partly circuitous.

Fig. 180.



Aneurism, by dilatation. [illegible]

The tumor has not existed for any very long time, before [illegible] begin to assume, in part, [illegible]. Fibrin is separated, an[illegible] arranged in concentric lamina[illegible] incorporated with the inner [illegible] strengthening it, a[illegible] it loses its coloring matter [illegible] becomes connected [illegible] organic arrangement [illegible] larization. But the greater bulk of the fibrin is not incorporated with the living texture; if it be adherent, it is only partially; most frequently it is loose in the cavity, with fluid blood playing round it; arranged in laminæ distinctly concentric, with the interior greatly deprived of its coloring matter. In consequence of this accumulation of solid fibrin, the pulsation and compressibility of the tumor are affected. The former may be somewhat less distinct at certain points than at others, according to the form and adhesion of the clot; and if the clot be both dense and large, while the aperture of communication between the cyst and artery is small, very little diminution of bulk may be effected even by energetic pressure. This state of matters, however, is no disadvantage; on the contrary, it is by such change that spontaneous cure is accomplished. The clot enlarging, comes to occupy the whole cavity; then becoming at all points adherent and incorporated with the cyst. The cavity is obliterated, the tumor consolidated. There is no room for entrance of fresh and fluid blood; it either passes on in its own proper channel, as in health; or as more frequently happens the solid tumor reacts on the arterial canal, bulging into it, obstructing its flow and inducing ultimate obliteration at that point. There being no longer an impulse from within, the restraining influence from contractile efforts of the adjoining tissues is now unopposed; and thereby gradual subsidence of the tumor, by absorption of the solid contents, is greatly favored. Ultimately, by continuance of absorption, and absence of increase, almost all trace of the tumor has disappeared; the artery is usually found occluded at the site; sometimes, but seldom, its canal remains still pervious (Fig. 136).

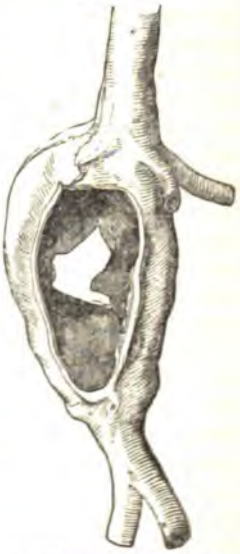
The occurrence of such a chain of events, however, is unfortunately rare. In the great majority of cases, unaided by our art, the coagulum does not solidify the tumor, but merely acts as a restraint upon its growth; interposing itself between the cyst and the arterial impulse, and thereby moderating the former's expansion.

As the tumor enlarges, the adjacent parts, more especially those in the direction of the principal increase, are displaced; and, as we have already seen, they may have important functions disturbed thereby. But there is not only mere displacement and interruption of function; change of structure is induced. Part of the superimposed textures becomes incorporated with the cyst; part is removed by absorption; sometimes true ulceration occurs. Fibrous texture resists long; and may determine the increase in a lateral direction. Also, by its unaccommodating opposition to the impulse beneath, much local pain, followed by constitutional disturbance, may result. Bone is less resisting; it cannot yield like the soft textures by elasticity; but it loses substance at the point compressed, by continuous absorption; and, if the pressure be great, ulceration may supervene. Most frequently, however, osseous destruction is only by absorption. Between the bone so affected, and the aneurismal contents, there may be interposed the ordinary cyst, more or less attenuated by pressure. Or that portion of the cyst may have been wholly removed, and its place occupied by the bone itself; the wave of blood washing the bare cancellated texture, without even a coagulum interposed (p. 260).

As thus the tumor enlarges, in spite of resistance from superimposed parts—impulse from within proving paramount—the symptoms are not merely local; there are pain, numbness, œdema, and more or less disturbance of function, according to the nature of the parts compressed, and the degree of their compression; and besides, the system is sooner or later involved in obvious irritation. The stomach and digestion fail, sleep is disturbed, strength and flesh decline, the pulse becomes weak and frequent; in fact, the ordinary symptoms of constitutional irritation are established; more or less urgent, in proportion to the resistance which is afforded, and the importance of the parts to which pressure is applied.

At length the crisis is approached: the tumor having reached the integumental surface, or the border of a mucous canal or of a serous cavity. The last intervening texture gives way; and then the fatal result is seldom long delayed. The opening is effected in different ways. 1. On the surface, the same occurs as with abscess; a portion of the skin is attenuated, sloughs, and separates. 2. In a mucous canal, the aperture is made by continued destruction of tissue at the part most compressed, either by absorption or by ulceration; most frequently, it is probable, by the latter. Or, it may happen that the progress of ulceration in the mucous membrane may be reversed. For example, an aneurismal tumor may compress the lower part of the trachea, threatening asphyxia; tracheotomy is performed, and a long elastic tube is worn in the wound; the extremity of that tube presses upon the apex of the aneurism; and by that pressure, ulceration of the mucous membrane is induced; the ulceration continues, advancing towards the aneurism, and so the latter's cavity may be exposed. 3. A serous cavity is opened, by attenuation of the serous membrane, from absorption under the continued pressure; and then laceration takes place at the attenuated part.

Fig. 181.



Aneurism of the descending aorta; burst. The patient died suddenly, in consequence. The aneurism produced mainly by dilatation.

When, at any stage of its progress, the aneurism becomes diffuse, the s nptoms are materially altered. Pulsation is diminished, in consequenc of pressure which is exercised on the arterial tube by the blood infilt d around; and it may happen—all untoward circumstances remaini loof—that thus the probability of spontaneous cure may be enha d. Indeed, in some cases, we have no hesitation in attri igin of spontaneous cure to the occurrence of the diffus t it is more likely that the issue will acquire an untowa this event; the limb is endangered, and secondarily th interruption to arterial flow, by rapid and profuse infilt the general areolar tissue, may be so great as at on ene of the limb, with its pernicious reaction on the terial influx may be but partially interrupted; eno maintain vitality, but ins icient for maintenance of due vital power. By and by, inflammation with unhealthy suppuration is not unlikely to occur in the infiltrated and broken up textures. And such an amount of inflammation is certain not to cease at the merely suppurative result; but, power of control being so much abased, it advances to gangrene, involving not merely the part, but the whole limb—all the more likely, if local stimuli have been imprudently employed. Early amputation then affords the only prospect of preserving life. But when part of the infiltration is superficial, discoloration of integument necessarily attends; and let not this be mistaken for the indication of gangrene already established.

The *Fatal issue* of aneurism may occur in various ways. 1. *By hemorrhage.* The intervening textures have all given way, as formerly detailed. A gush of blood follows [illegible] nent of the open condition. But this is not always at once fatal, especially when the aneurism opens on a mucous membrane, even in the largest and most active tumors. A portion of the coagulum, becoming impacted in the orifice, for a time stems the flow. By and by this plug may be extruded or dislodged, and hemorrhage returns; again it may be arrested, and again return; and thus by repetition of bleedings, the patient is ultimately exhausted, and perishes.[1] 2. *By pressure on important parts;* as on the trachea, œsophagus, nerves, &c. Aneurisms of the arch of the aorta, for example, usually prove fatal by the injurious effect on respiration. 3. *By mere constitutional irritation;* the system sympathizing with the local disorder. And, *cæteris paribus*, the greater the obstacles to the tumor's enlargement, the greater the amount of constitutional disturbance. Fibrous coverings oppose onward progress of the aneurism to the open state; but do not avert, though they may delay, the fatal issue. Ere hemorrhage has had an opportunity to occur, the patient may have been carried off by the wearing hectic. 4. *By inflammation and suppuration of the sac.* The secretion of pus may prove great and protracted; and even amputation may fail to arrest exhaustion therefrom. 5. *By diffusion of the aneurism;* inducing gangrene of the limb, in the manner formerly explained. Typhoid symptoms may at once set in with force, and forbid the doubtful chance of amputation.

Diagnosis of Aneurism.

The Diagnosis of aneurism is one of the most important points in practical surgery. The following considerations will ordinarily enable us to escape from error. Chronic abscess, and glandular or other tumors, are the morbid states most apt to assume the aneurismal characters. Often they simulate the disease very closely; strong and distinct pulsation being communicated by a neighboring artery of large size.

But—1. Aneurism is soft and compressible from the first, and then becomes hard by solidification of its contents. An abscess may be soft from the first, but more frequently begins with induration, and softens secondarily; reversing the progress of aneurism. A small, chronic, and scrofulous abscess may be soft from the first; and may perhaps seem to be compressible. Situate, for example, in the groin, in the axilla, or at the root of the neck, it may seem to disappear by pressure, beneath the surrounding hardness; but, on removal of the pressure, the lively resilience of the aneurism is wanting. An enlarged gland, or other tumor, is invariably first hard, then soft, and never capable of being dispersed by pressure; and, unless suppuration occur, the softening and fluctuation do not supervene at all.

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[1] It is remarkable what powers of arrest and delay Nature has in this particular. The late Mr. Liston died of aortic aneurism. In July profuse hemorrhage took place from the windpipe; the aneurism had opened then. In December he sank under respiratory oppression; and there had been no bleeding during the interval—although, unhappily unaware of the disease, he had been habitually indulging in the most violent exercise. On dissection, three apertures were found communicating between the aneurism and trachea; and each one was firmly corked by its plug of fibrin.

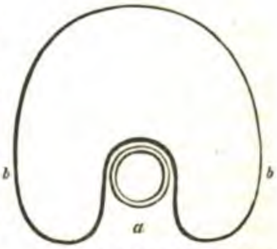
2. Pulsation is equable in aneurism. At every point, unless much alteration by partial consolidation have occurred, pulsation is felt equally distinct. Whether the tumor is compressed directly downwards, or elevated and compressed laterally, pulsation is the same. A solid or other swelling, not aneurismal, laid over the track of an artery, and receiving impulse from it, has a very distinct pulsation when the first mode of pressure is employed; but when raised, and held by the sides, this pulsation will be found either very faint, or altogether absent.

3. Aneurisms of the large arteries have frequently a double impulse; the first corresponding to the diastole of the artery; the second taking place between it and the following diastole, and corresponding to the systole of the artery. Tumors which merely receive arterial pulsation exhibit only one impulsion, isochronous with the arterial diastole.[1]

4. Pulsation of aneurism is felt from the first. Not so, in the case of swellings not aneurismal. At first these are small; and, not encroaching on the vessel, they receive from it no impulse. Only after some time do they enlarge to such an extent as to be in close contact with the artery; and then they receive its pulsation.

5. Aneurism has expansion coincident with pulsation. The fingers placed firmly on the tumor diminish it more or less; pulsation is felt increasing in proportion to the pressure employed; and at each impulse there is a palpable elevation of the hand, by expansion of the walls of the cyst. A swelling not aneurismal, on the contrary, may be elevated at each stroke of the vessel, as well as have its apparent impulse augmented by increase of pressure; but it has no expansion of its entire bulk, at every point; it is simply raised—and, whether in systole or diastole, its dimensions are unaltered. There is one exceptional case, however, which may render diagnosis very difficult. If a chronic abscess, or other cyst, overlay an artery thus; then its pulsation will be equal in all directions, each impulse will be accompanied with a sensation of expansion, and bruit may doubtless be distinct. Extrication from error, however, is still within our power; especially by reference to the fourth

Fig. 182.



Section of an abscess, or other cyst (*b*), overlaying an artery (*a*). The aneurismal state must be closely simulated.

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[1] Lancet, No. 1133, p. 549.

test. Inquiry into the swelling's history will inform us, that when small and recent it showed no sign at all aneurismal.

6. An aneurism ordinarily affords both thrill and bruit to touch and auscultation; and the latter, in the larger arteries, may be double, like the impulse (p. 493). Another tumor may possess the bruit (p. 497), but has not both conjoined; unless, indeed, it be the exceptional case just stated.

7. Pressure on the cardiac aspect of the aneurism diminishes its pulsation, bulk, and thrill; pressure on the distal aspect has a precisely contrary effect. Another tumor may have its apparent pulsation similarly affected; but the pulsation only.

8. Change of relative position affects the aneurism but little. Pull it rudely aside, and, by impeding arterial flow, the pulsation, expansion, and bruit may be diminished; but, though diminished, they are still there. Do the same to another tumor, and pulsation is gone quite.

9. Perhaps the tissues are lax enough to permit our tracing the vessel's course with the fingers. If the tumor be aneurismal, it will be impossible to detach it from the artery; if non-aneurismal, the vessel will be found at all parts perfectly free. Even at the supposed neck of the aneurism, perhaps, the finger's point may be inserted between the tumor and arterial tube.

10. In aneurism of the extremities, the limb beneath the tumor is shrunk, wasted, pained; perhaps œdematous. And these appearances are not so marked, if they exist at all, in the case of a tumor which merely simulates aneurism.

Causes of Aneurism.

The disease is more frequent in men than women; and seldom occurs before the period of puberty. In the lower animals it is not common, except in the ass, as connected with the presence of an entozoon—the strongylus armatus. These animals lie within the aneurismal sac; their tails being entangled in the fibrinous clots, while their heads are free, and exposed to the current of blood.[1]

1. *Predisposing causes.*—For the formation of true aneurism, as has already been stated, the existence of atheromatous degeneration of the arterial coats is essential. The most frequent site of such degeneration, and consequently of aneurism, is at the turnings of the blood's current; whether by the natural curves of the vessel, as at the arch of the aorta; or by the giving off of large branches, collaterally, or in bifurcation. The period of life most favorable for the morbid change, is between the ages of thirty and fifty. By previous degeneration, the elasticity and tone of the vessel are greatly impaired at the part changed; and the effect is usually proportioned to the extent of structural change. At each impulse from the heart, the coats yield before the wave of blood; but, wanting resilience, they fail to recover themselves as before. And thus dilatation is established and increased; the dilatation in form and extent probably proportioned to the extent of arterial degeneration. The dilatation may proceed; itself forming an aneurism. Or the inter-

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[1] Otto's Pathol. Anat. by South, p. 320; and Monthly Journal, Jan. 1850, p. 90.

nal and middle coats give way; and then aneurism more rapidly advances, in the manner already detailed (p. 483). When aneurism has been formed by dilatation only, communication between the cyst and artery is of course wide and free; often of the same extent as the cyst itself. When it has resulted from giving way of the coats, the aperture is of more limited dimensions; usually of circular form, sometimes no larger than a quill; with margins well defined, smooth, and often of great density.

Senile earthy degeneration may also induce aneurism; but does so much less frequently than the atheromatous. The change, it is probable, occurs in the following way. Where the earthy deposit is greatest, a greater or less narrowing of the arterial canal is occasioned. On the cardiac aspect of this constriction, dilatation occurs. This may itself prove aneurismal. Or, as is more likely, the coats at this part yield either by laceration or by ulceration; and then the aneurismal formation proceeds in the ordinary way.

2. *Exciting causes.*—The more prominent of these are violent muscular exertion, and mental emotion; either of which, but more especially the former, may directly cause the giving way of the coats.

Certain occupations favor the disease. Those persons, for example, who are exposed to intemperance by their vocation, as well as compelled to undergo heavy labor, which often demands sudden and great exertion, are daily under the operation of both predisposing and exciting causes. And, again, if the elderly and not too temperate patient be by his calling exposed to sudden stretching of a vessel, after a prolonged relaxation of it—without hard labor, or great muscular effort, occasional or habitual —aneurismal formation is likely to occur. For instance, the postilion, or any one similarly circumstanced, who has for hours his popliteal artery much relaxed in a bent position of the limb, may by sudden stretching of the member, on resumption of the erect posture, cause partial rupture of the coats; and if arterial degeneration be present, as is not unlikely, aneurism certainly supervenes.

In some cases, atheromatous degeneration pervades the whole arterial system; and tendency to aneurismal formation is in consequence universal. Patients so affected are said to labor under the *Aneurismal Diathesis;* prone not only to aneurism, but to aneurisms; the tumors, in such cases, seldom proving single but gregarious. The existence of such a state is indicated by a peculiar thrilling jar of the pulse, as well as a wiry hardness of the vessels, and an obvious cachectic state of the patient. It contraindicates surgical interference with any aneurism; however favorably adapted the tumor might otherwise seem for operation.

Cure.

Towards this end, as already stated (p. 489), there occur:—coagulation of the aneurismal contents; reaction of the superimposed and surrounding parts on the solidified tumor; compression, thereby, of both tumor and artery; probably obstruction of the latter by extension of the coagulum. The fibrin loses its coloring matter, and in part becomes organized—where in contact with the cyst; absorption of the solidified tumor gradually advances; ultimately all traces of the aneurism have almost or wholly disappeared; and the artery is either permanently obstructed, and obliterated, at that point; or—as more rarely happens—it remains free and pervious.

The cure may be either Spontaneous or Surgical.

1. *The Spontaneous.*—The changes formerly described, as effecting spontaneous cure, may be induced by various circumstances. 1. *By pressure on the cardiac side of the tumor.* The artery may be here compressed by the aneurism itself, it having enlarged chiefly in that direction, and being bound down on the vessel by fibrous investments. The arterial flow to and into the cyst is consequently moderated, and the occurrence of solidification favored. Or similar pressure, with similar effects, may be exerted, not by the original tumor, but by the formation of another aneurism in the cardiac proximity. The cure of one disease, by the establishment of another. Thus, for example, a subclavian aneurism has been cured by the pressure of a nascent tumor formed on the arteria anonyma. But perhaps, indeed, it were an error to apply the term cure to such an event. A more favorable result is the third variety of pressure; when a tumor, not aneurismal, and unconnected with the vessel—perhaps an enlarged gland—compresses the artery, or artery and aneurism both, so as to induce coagulation in the cyst. The principal disease is cured; and the secondary formation, the independent tumor, may be dealt with afterwards if necessary. 2. *By occlusion of the aperture of communication;* independently of pressure, or moderation of the arterial flow. A firm portion of coagulum becomes detached from the fibrinous mass occupying the interior of the cyst, and is impacted in the aperture; either preventing, or greatly limiting the arterial influx; and obviously favoring contraction and solidification of the tumor. The artery itself may remain pervious or not; more frequently it also is occluded. To this result it is plain that a smallness of communicating aperture is very favorable; and were we at all times able, by auscultatory and other signs, to ascertain the dimensions of the aperture, we might more truly predicate, in those cases of internal tumors which are inaccessible to surgical interference, the result of treatment with the view of obtaining spontaneous cure. 3. *By inflammation and gangrene of the cyst;* not partial but including the whole. Gangrenous inflammation of the aneurismal cyst may occur spontaneously, or be the result of external injury. It may follow ligature of the artery; and then it not only involves the diseased formation, but includes the whole limb as well, demanding amputation. But with this we have nothing to do at present; treating not of the surgical, but of the spontaneous cure. If the slough include the whole cyst, and spread no further, a fortunate issue may be predicated. The dead part separates in the usual way; but not until the surrounding living textures have become densely infiltrated by fibrinous exudation; and not until by such plastic exudation, all the implicated bloodvessels, including the artery at the aneurismal part, have been consolidated. As the slough separates, consequently, no hemorrhage ensues; and healing advances in the ordinary way. Profusion of purulent formation is the principal danger; when the suppurated part is large, and the patient already low in system.

Hectic may ensue. If gangrene be but partial, however, and do not involve the whole cyst, there is the greatest hazard. On separation of the slough, the open cyst and artery will be exposed; hemorrhage will be great, and probably fatal. 4. *By the aneurism becoming diffuse.* As formerly observed (p. 485), if suppuration or gangrene do not occur, the pressure of the diffuse infiltrated blood on the cardiac portion of the artery may so restrain its flow, as greatly to favor the occurrence of spontaneous cure. 5. *By obliteration on the distal aspect.* The aneurism, by making especial pressure there, may in truth effect a result similar to that of Brasdor's operation. The vessel may be gradually and finally shut up; and if no collateral branch intervene between the the occluded part and the opening into the aneurismal cyst, cure will follow (p. 504).

2. *The Surgical Treatment.*—Spontaneous cure, by any mode, is comparatively of rare occurrence; and is not to be trusted to in practice, when other means are in our power. In olden times, the surgeon did not hesitate to interfere directly and boldly. In the time of Celsus the tumor was opened by the knife; and to restrain the frightful hemorrhage, a heated cautery was thrust into the wound. Or, as practised by Rufus and Antyllus, the aneurism was cut into and cleared out, the vessel having been previously secured by ligature above and below the aneurismal part. After introduction of the tourniquet by Morel, in 1674, the procedure became somewhat less formidable; hemorrhage being restrained by pressure above, until the artery had been secured, at least temporarily. Or, finding these direct modes of operation very disastrous in their result, as might well have been anticipated, it was not unfrequently deemed expedient at once to amputate the limb, above the aneurism—rather than encounter certainty of hemorrhage after deligation, and probability of bleeding, along with certainty of exhausting suppuration after the cautery. But as the nature and treatment of disease became better understood, this department of practical surgery improved. About the middle of the eighteenth century, the operations for aneurism became less coarse in themselves, and more happy in their results. In 1740, Anel—doubtless having become aware that, for the establishment of cure, it is not essential that the sanguineous flow should be entirely arrested in the part—cut down above an aneurism at the bend of the arm, and, securing the artery there, without opening the sac, effected a cure. Be it remembered, however, that this was an example of false aneurism; and that consequently the arterial coats, where tied, were not necessarily in a degenerated state, as they must ever be in the immediate vicinity of true aneurism. For John Hunter was reserved the merit of really improving the operation. He, reasoning further on the fact, that complete arrest of the flow is not essential to cure, saw how this enabled him to seek a healthy portion of artery on which to apply the ligature; one capable of plastic exudation, and not prone to ulceration. He saw that it was not imperatively incumbent on him to tie the vessel immediately above a true aneurism, where its coats must be diseased; but that it was in his power to select a portion higher up—removed, perhaps, to the extent of several inches. Of this power of selection he did not fail to avail himself; and in 1785, in

a case of popliteal aneurism, instead of securing the artery in the ham, he tied the femoral near the middle of its course. Although the practice proved at first unsuccessful—the mode of operation, not the reason why, being defective—the soundness of the Hunterian theory stood unshaken; and the subsequent experience of Desault, and others, with operations better executed, obtained for it ample confirmation.

The original want of practical success resulted from the faulty mode in which the ligature was used. There existed in the profession an excessive dread of injury to the arterial coats, by a small ligature tightly applied. It was feared that they would be cut through too soon, ere yet the canal had been consolidated; and that the most serious hemorrhage would ensue. Accord[illegible]d tapes were tied on; and others were applied loosely, to b[illegible]d as circumstances might demand. In an over anxiety to sav[illegible] arterial tissue, it was unduly detached and manipulated, so as to cause either ulceration or sloughing; and thence the much-dreaded hemorrhage; the means adopted to prevent this, turning out the most likely to insure its occurrence.

Success depends mainly on a skilful use of the ligature; and too much caution cannot be used in its application. The vessel is exposed by careful dissection, somewhere on the cardiac side of the aneurism; not so close as to endanger the encountering of degenerated coats; not so far removed as to favor too free a collateral supply of blood still remaining to the tumor. The external wound should be rather too large than too small; facility and safety of performance being closely allied in this operation. The incisions are made with a small finely-edged scalpel, used lightly. Neither directors nor blunt knives should be employed; for they must bruise and tear to a certain extent; and the simpler and smoother the cut is, the greater is the probability that both wound and artery will assume a salutary condition. The vessel having been exposed, its sheath—pinched up by dissecting forceps—is opened to the extent of about half an inch; and by repeated touches of the knife's point, assisted by forceps, the arterial coats—looking at last white by the insulation—are completely detached from all neighboring tissues; only however to a very limited extent; not more than what is barely sufficient for the passage of the needle and ligature. The aneurism-needle should have its point neither too sharp, to endanger wounding of the arterial coats; nor too blunt, to render tearing and force necessary for its passage. Armed with a firm, round ligature, of silk or thread—well waxed, to facilitate application—it is gently insinuated beneath the artery at the detached point; great care being taken to exclude all textures, save the arterial, from within its circuit; more especially nerves and veins. Having passed, the ligature is laid hold of, and retained, while the needle is withdrawn. The loop of the ligature is then cut, and one half pulled gently away. The remaining portion is secured on the vessel with a reef knot (p. 318); drawn with such tightness as affords to the operator's fingers the peculiar sensation of the internal and middle coats having given way. One end is cut off close to the knot; the other is left pendent. The wound is brought carefully together by suture and adhesive plaster—leaving the protruding end of the ligature readily amenable to both sight and touch—and is treated so as to promote adhesion. The limb is placed in a relaxed and comfortable position, and so retained.

In the case of deep-seated vessels, the more complicated needles of Weiss, Trant, &c., may be found useful; but in the majority of cases, the ordinary instrument, with ordinary skill, suffices.

The ligature is not interfered with until the usual period for its separation has elapsed; from ten to twenty days. Then its free extremity may be gently touched. If found loose in its deep part, it is carefully withdrawn; if still adherent, no pulling is employed; we await patiently spontaneous loosening; and, as in the case of dead bone, regard it as our duty to interfere and take away only when the natural process of detachment has been completed.

By some it has been considered preferable to employ two ligatures, dividing the artery between; a modification in the deligation of arteries as old as Ætius, and strenuously advocated by Abernethy. Various points may be stated in favor of this mode of operation. The artery retracts freely, and thereby thickens its parietes, while it contracts its calibre; the ligature is brought into close contact with healthy structures; and consequently there may be less chance of suppuration, ulceration, and hemorrhage. Besides, it has been thought important—especially in the case of the carotid—to avoid the double impulse which a single ligature has to sustain; the one direct from the heart; the other dependent on the collateral circulation.[1] Most certainly, if the ordinary operation have been improperly conducted; that is, if in our attempts to expose the vessel cleanly, it have been detached too extensively from its surrounding connections—thereby rendering the occurrence of either ulceration or sloughing more than probable—let two ligatures be applied; one at each extremity of the separated portion.

Fig. 183.

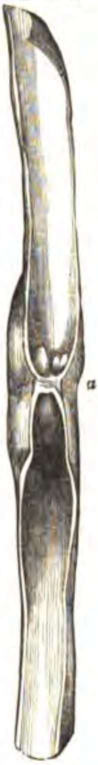

Fig. 184.

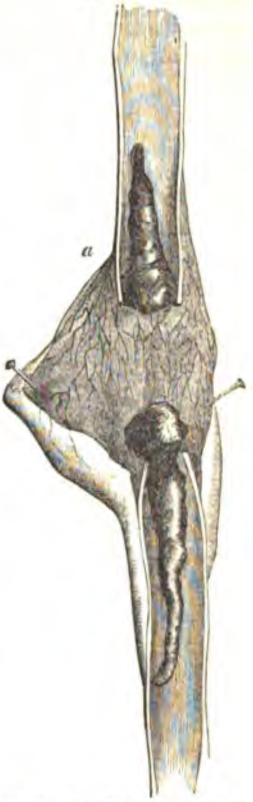

Fig. 183. Carotid of a dog; 48 hours after deligation. Recent effects of ligature. At *a*, the arterial coats cut across. Plasma begun around; and a clot on either aspect of the deligated part. Fig. 184. Carotid of a dog; 6 days after deligation. Artery cut across. The contracted ends occupied by coagulum. In the sheath pinned out, external vessels (*a*) are seen coursing onwards to occupy the interior.

The effects of the ligature, well applied, are as follows:—There is mechanical arrest of the arterial flow at the deligated point; throwing a stress on the collateral circulation; and, by weakening the main current, on the distal aspect of the ligature, favoring coagulation of the aneurismal contents, with solidification of the tumor. The internal and middle coats are at once cut through; the former cleanly, as with a knife. They resile on each side of the ligature, and the noose of this embraces only the external coat. The cut surfaces of the internal coat are kept in close contact; and, being cleanly incised, in close apposition, and free from compression by the ligature, they unite by adhesion. Fibrinous exudation takes place for this purpose; extending a little distance on each aspect of the ligature. The exudation becomes fully organized; and thereby the arterial canal, at that part, is permanently and firmly closed. And this process of exudation, organization, and consolidation, is facilitated by means of a coagulum, formed almost immediately after application of the ligature. On the cardiac aspect of the ligature, the blood is thrown into a condition of comparative stillness; favorable for coagulation, up to the nearest collateral branch. And the result usually is, the production of a slim and tapering clot; its base resting on the arterial tissue at the deligated point; its apex loose, and nearly on a level with the nearest collateral branch. This — slender though in most cases it is—will doubtless have the effect of removing the blood's impulse from the site of exudation and organization, and so will facilitate completion of the process of occlusion. Whence it is obvious how anatomical knowledge may often be of service, in directing selection of the site of deligation, to a point where no collateral branch is given off in the immediate and cardiac vicinity. Otherwise, there might be, instead of remora, an increased tumult of circulation at the part which is undergoing the process of obstruction.

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[1] Chassaignac. Gaz. des Hôpitaux, Nov. 30, 1848.

Fig. 185.

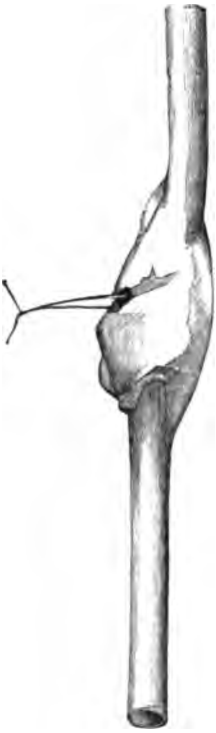

Fig. 186.

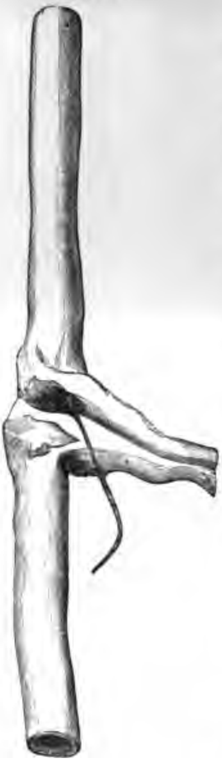

Fig. 185. Carotid of a dog; 96 hours after deligation. Further advanced. The ligature seen imbedded in a large mass of organized plasma. Fig. 186. Carotid of a dog. 13th day after deligation. The ligature detached, and coming away in the groove formed in the organized plasma.

Plastic exudation is not limited to within the vessel. It occurs, and more extensively, on its exterior; forming a dense swelling of some size, within which the ligature's noose is deeply imbedded. The highly important, and even essential character of this external exudation of plastic fibrin, is fully elucidated by the experiments of Mr. Spence; from whose unpublished drawings the illustrations herewith given are derived. He has shown clearly that the internal clot, so far from being, as was supposed by Manec and others, essential to the separation of the ligature without hemorrhage, is not unfrequently wanting when the vessel has been successfully tied; the closure being entirely effected in these cases by the plastic exudation between the cut edges of the internal coats, and by the bulky fibrinous mass which forms within and around the sheath. It is this external exudation which, becoming vascularized, forms the medium whereby blood is supplied from all the surrounding parts to the important new formations within the external coat of the occluded vessel; and which, by its equable pressure upon the divided ends of the internal coats, prevents the tender adhesions within the sheath from being broken up, even when there is no coagulum. And hence arises an important practical caution; that it is not only advisable, in ligature of an artery to avoid unnecessary separation of the vessel from its sheath, but also that every undue interference with the soft parts around is also greatly to be deprecated. According to Mr. Spence, the vessels of the new plastic lymph are formed with great rapidity. In one instance, in the dog, he found them present in considerable numbers sixty hours after the operation. After a longer time, vessels begin to pass even into the clot when this is present; these vessels being always in connection with those of the sheath and external lymph, and not proceeding, as has been supposed, from the interior of the artery[1] (Figs. 184, 187).

Fig. 187.

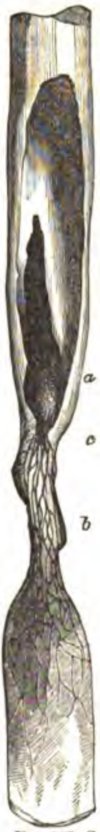

Fig. 188.

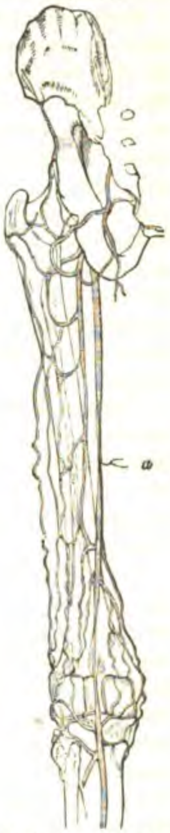

Fig. 187. Carotid of a dog; 12th day after deligation. Vascularization of the clot, by vessels from without. At *a*, the artery cut open, showing the clot; at *b*, the external vessels, coursing onwards, enter the clot at *c*. Fig. 188. Collateral circulation shown in the thigh. At *a*, the femoral artery has been obliterated by ligature.

The portion of the external coat included in the noose of the ligature is necessarily killed, by mechanical injury; and being dead, it must be separated. Detachment is effected in the ordinary way; by inflammation and ulceration. These destructive processes extend no further on either side of the ligature, than what is sufficient for detachment of the foreign body, with the dead portion of arterial tissue. And no accident by bleeding occurs; for two reasons;—First, on account of the limited extent of ulceration; second, because the arterial tube has been, at that part, and some way beyond it, completely consolidated.

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e first part of Mr. Spence's researches may be found in the Monthly Journal, May, The second is unpublished.

Thus the ligature, and the dead portion of areolar coat embraced by its noose, are detached from the living texture. There may be a slight obstacle to extrusion, from the external fibrinous deposit—threatening to confine, as the substitute bone often does the sequestrum; but a slight touch of the free end of the ligature suffices to counteract this. On the ligature's final extrusion, the hiatus, so occasioned, is quickly filled up by fresh exudation; and all is consolidated. A dense compact swelling, of some size, thus comes to occupy the place of the arterial tube, at the deligated point.

Such copious exudation and consolidation were essential, as has been seen, to prevent accident by hemorrhage during ulcerative separation of the ligature. But now that this event has been safely achieved, the fibrinous mass is found gradually to diminish by absorption, and at length almost entirely to disappear; like provisional callus, in fracture; the existence of any salutary adventitious growth usually ceasing with its usefulness. Ultimately, so far from there being a swelling or induration at the deligated point, that portion of the artery is found dwindled down to a mere thread, and the normal texture of the surrounding tissues is almost wholly restored. Above and below the obliterated portion, the vessel's calibre gradually tapers till the nearest collateral branch is reached; and there the normal dimensions are usually restored. The internal coagulum shrivels, and ultimately disappears, by absorption.

Thus it is plain, that the main object in conducting the operation and subsequent treatment is, in truth, maintenance of a low grade of the inflammatory process, and prevention of true inflammation; attainment of plastic deposit, and the averting of suppuration and ulceration—except what barely suffices for separation of the ligature and its included slough.

Such are the effects of ligature on the artery itself; when well applied on a sound portion. And the chief advantage of the Hunterian mode of operation is, that it enables us to select the site of operation, with a view to the latter indication. The effects on the tumor are, instant arrest of the pulsation and bruit; subsidence as well as silence of the swelling; and gradual induration of it, obviously, by coagulation of the contents. This chain of favorable events is the result of the main current having been abruptly turned aside into collateral channels. And it may happen that the process of cure, thus begun, proceeds rapidly to completion without even a semblance of interruption; but more frequently it is otherwise. Collateral circulation existed previously to the aneurismal formation; but it became more full and free immediately thereafter; and its increase may, in the great majority of cases, be said to have kept pace with increase of the tumor. A third and more decided enlargement follows on performance of the operation; and the collateral channels are for a time strained, as it were, until they have accommodated themselves to the increase of their burden. At first the temperature of the limb falls; in consequence of arterial influx being for a time actually impeded and impaired. But subsequently, it rises even higher than the previous standard; arterial circulation having resumed its wonted copiousness, and the superficial vessels, especially, being more plentifully supplied. Some of these, scarcely appreciable before, may be both seen and felt pulsating vigorously. Sometimes, the temperature again falls beneath the standard of health.

In consequence of re-establishment of the limb's circulation, pulsation often returns in the tumor; blood having freely come again by the circuitous route into the cyst, and into the main vessel on the distal aspect of the ligature. The ligature never wholly arrested sanguineous flow there, even for a moment; collateral circulation is at all times too free to admit of this. It was only moderated; and this moderation, conjoined with removal of the heart's impulse, was sufficient to originate the process of solidification, and temporarily to withdraw pulsation from the tumor. Complete arrest of the flow is not essential to cure; nor indeed is it desirable. We do not desiderate an empty condition of the aneurismal cyst, but that it should be filled by solid contents. And, to afford a pabulum for solidification, a certain amount of circulation is expedient; slow and dull, to favor coagulation; and without energy of impulse, so as to maintain no distending or expansive effect on the cyst. If, after a day or two, the freedom and fulness of circulation are such as to restore a diminished impulse to the swelling, this need be no matter of surprise; neither let it give rise to unnecessary alarm. The chance of injury thereby is readily obviated, by applying moderate and uniform pressure on the part by means of careful bandaging; of course, beginning the application of the roller at the furthest extremity of the limb, and leaving no part unsupported. In a short time, pulsation again ceases; solidification is completed; and disappearance by absorption advances, in the manner formerly described.

Such is the modern operation for aneurism, with the effects which are expected to issue from it; when properly conducted. But there are both a preparatory and subsequent treatment, of much importance; neither of which can ever with safety be neglected. A patient is not to be taken from his ordinary avocations, and at once subjected to the operation. For some day he should be kept in a state of repose; his bowels and general secretions should be attended to; his diet should be restricted, and all stimulant fluids absolutely prohibited. If there be a fulness of the circulation, or any apparent tendency to vascular excitement, either a moderate bleeding should be practised, or aconite or antimony given. After operation, complete quietude of both body and mind is maintained and every other means taken likely to insure a gentle and moderate state of the general circulation; this being obviously favorable to advancement of the process of cure. And about the usual time of the ligature's separation, all moral and physical causes, likely to accelerate circulation suddenly and much, should be especially avoided. Regimen is strictly antiphlogistic. The limb is placed and retained in a relaxed and comfortable posture. No severe pressure is applied to the tumor, under any circumstances, lest suppuration or gangrene be induced; and no pressure in any degree need be employed, unless pulsation return soon after the operation; or unless, at a later period, diminution of the tumor become slow and unsatisfactory. Nor should manipulation of the tumor be frequently and rudely practised; otherwise suppuration of the cyst is not unlikely. It is no doubt essential to watch the condition of the swelling; and it is satisfactory to know that pulsation is absent, that solidification continues complete, and that diminution advances favorably; but such knowledge can be readily enough obtained, without rude handling. All impertinent curiosity should be rigidly abstained from by the surgeon, and strictly prohibited on the part of others.

Stimulant frictions, or more direct applications of heat, may perhaps be thought of immediately after the operation; the temperature of the limb having fallen considerably below the normal standard. There can be no worse practice. At this time, vital power in the limb is very low; and if the stimulation induce any considerable amount of vascular excitement, as is most likely, gangrene is almost sure to follow. Either let the limb alone altogether; or swathe it gently in a flannel roller. The temperature, as already stated, of itself rallies; and power, along with circulation, is gradually restored.

After deligation of the large arteries near the trunk of the body, free venesection, perhaps repeated, is often advisable; in order to save the important organs within the great cavities, from the evil effects of sanguineous determination, caused by sudden interruption of the main current. After ligature of the common carotid, for example, the lungs are in much danger by congestion; which may induce an apoplectic state of that tissue, or pass on into pneumonia; casualties, tending to a fatal result, which can be obviated only by loss of blood.[1]

At one time it was a question, what period was most favorable for operation; and in general it was held that some considerable delay was advisable, in order to permit the collateral circulation to have become fully established. But it is now well understood, and generally admitted, that so soon as there is aneurism there is collateral circulation; more likely to prove excessive, and cause trouble and anxiety by undue return of pulsation—than to be deficient, and induce gangrene directly by failure of arterial supply. Gangrene is certainly one of the dangers of the operation; but in the majority of cases in which it has occurred, it has probably been not the direct but the indirect consequence; not by insufficiency of arterial supply, but by induction of over excitement; not by the fault of the operation, but by that of the surgeon in his subsequent treatment. The limb has been rubbed, heated, or otherwise stimulated, prematurely, and to excess. Delay is *unnecessary*, on account of collateral circulation. So soon as the tumor is observed, it may be made the subject of operation; provided other circumstances of the case are favorable. And further, delay is *inexpedient;* for the older the aneurism, the larger the tumor; and the greater its deleterious consequences on both part and system. By operating early, we save constitutional irritation; as well as displacement, interruption of function, and change of structure, in the parts—perhaps important—adjoining the disease.

But cure may fail, even should the deligation itself succeed. Success is not invariable. 1. There may be an idiosyncrasy of system, whereby coagulation of the blood is prevented; a diathesis analogous to the scorbutic, or to that which is termed hemorrhagic. In such circumstances, the remedies tending to oppose that state are to be employed; acetate of lead and opium, sulphate of soda, &c. (p. 329). 2. Or there may be a want of reactive pressure and support, on the solidifying tumor, by superimposed textures. As has been well shown by Mr.

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[1] London and Edinburgh Monthly Journal. January, 1842, p. 1.

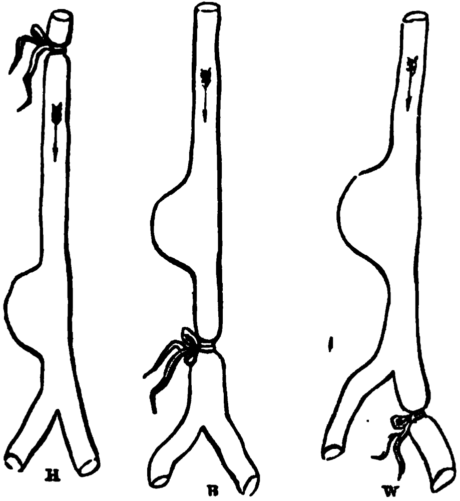
Porter, aneurism of the upper part of the carotid is unfavorably situated in this respect. From a want of investing texture on the pharyngeal aspect, the tumor not only extends chiefly in that direction, during growth; but also, after operation, it may fail to solidify, contract, and disappear. Other aneurisms, when superficial, may labor under similar disadvantage. Such deficiency is to be atoned for, as far as circumstances will permit, through application of artificial pressure and support, by compress and bandaging.

Other methods of treatment, which have been and still are in use, now claim our attention. *The operation of Brasdor* is the reverse of that of Hunter; application of ligature, not on the cardiac, but on the distal side of the tumor—in its near proximity. Obstruction occurs at the point tied; coagulation and remora of the arterial contents take place up to the nearest collateral branch; and, if there be no vessel given off between the tumor and the point of deligation, the former will obviously be included within the range of delayed and coagulating blood—a state favorable for origination and advancement of the process of cure. If, however, any branch of considerable size do interfere, it is equally plain that the effect of deligation will be to cause an increased turmoil at and within the tumor, and to aggravate the disease accordingly. Also much difficulty may be experienced in cutting down upon the vessel. It may have been already obliterated; it may be much displaced from its normal relative position; in the great majority of cases, as formerly stated, it is certain to be somewhat diminished in size; the surrounding parts may have been the seat of a chronic form and low grade of the inflammatory process, and the vessel may be intimately blended with condensed and infiltrated structure.

This mode of operation, then, applied generally to aneurism, is obviously and vastly inferior to the Hunterian. Yet its employment is occasionally expedient. When an aneurism is situated so close to the trunk of the body, as to preclude the application of ligature on its cardiac side, are we to abandon all aid from surgical interference, and content ourselves merely with medical treatment in the hope of facilitating the accession of spontaneous cure? Instead of thus, as it were, leaving the patient to his fate, we may practise the distal operation; if circumstances seem otherwise favorable; and if the patient, after having heard an honest explanation of the risk, is willing and anxious that the attempt should be made. In aneurism, for example, of the common carotid at its origin, experience tells us that we need not attempt the Hunterian operation, by ligature of the anonyma; that is certain to fail. Brasdor's operation, on the contrary, is not unlikely to succeed; inasmuch as there is a long space of the carotid from which no branch is normally given off; and consequently no vessel is likely to intervene between the tumor and the distal ligature.

Even in favorable circumstances, however, there is always one serious objection to this operation. In order to avoid the risk of an intervening collateral branch, or, in other words, to secure obliteration of the artery and aneurismal sac, it is essential that the site of deligation be not far removed from the tumor; and consequently, there is great probability of the arterial coats being unsound at the point tied. Ulceration and hemorrhage are the result. And the practical consequence of all is, that the statistical results of this operation are as yet far from satisfactory.

Fig. 189. Fig. 190. Fig. 191.



Hunter's, Brasdor's, and Wardrop's operations exemplified.

A modification of Brasdor's operation is usually associated with the name of *Wardrop*. In my humble apprehension, under all circumstances inexpedient; because containing within itself the elements of failure. Supposing aneurism to exist in an arterial trunk, just above its bifurcation—it is proposed to tie one of the branches only, and from that interference to hope for a favorable result. According to this system, for example, in aneurism of the arteria anonyma, it would be held sufficient to tie either the subclavian or common carotid. Here there is a manifest certainty of a collateral branch, and that of very great size, intervening between the tumor and the ligature; a circumstance, as already seen, hostile to success.[1]

Temporary ligatures have been proposed; and trial, sufficient to establish their inexpediency, has been made by Travers, Dalrymple, &c. Temporary application is unequal to effect, with any certainty, occlusion of the canal, at the deligated point; and the disturbance and injury done to the vessel, however short the time of application, are just as likely to induce ulceration and hemorrhage, as if the deligation had been permanent; perhaps more so, inasmuch as, besides mechanical interference in application of the noose, there is added that which is necessary to effect its removal.

Thick and flat ligatures were at one time used, to meet the false dread of premature division of the vessel's coats; an event of which experience has shown there is no danger, if the tissue be in even a tolerably sound condition. Draw a firm round ligature, as tightly as you may, the inner and middle coats alone yield; the areolar remains entire. A greater risk is that which comes by ulceration or sloughing of the arterial coats, opening into a yet patent canal; plastic exudation being either absent or imperfect. And such risk is mightily contributed to by flat tapes; their application not only entailing extensive separation of the arterial tissue from its surrounding connections, but also rendering it certain that a considerable portion must slough and separate, and that consequently no slight amount of suppuration and ulceration—the main danger—shall be inevitable ere the foreign substance can be detached. Although the high name of Scarpa was attached to such practice, it need excite no wonder that it has fallen into complete desuetude; as also the plan of interposing compresses, of various kinds, between the artery and ligature. All such means increase the chance of ulceration and sloughing; while, at the same time, the giving way of the internal coat is prevented. This tunic, being included as well as the others in the noose, is incapable of plastic exudation at that part; and must slough, inflame, and ulcerate.

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[1] Let the reader, however, judge for himself, by considering Mr. Wardrop's own statement in the Cyclopædia of Practical Surgery, vol. i, pp. 226–239.

Similar objections exist to exposure of the vessel by incision, and then, instead of deligation, applying graduated pressure directly to the tissue, by means of Dubois' serre-nœud, or Assalini's compressor. The practice had no success, and is obsolete.

It has been proposed to extend the principle of subcutaneous puncture to the deligation of Arteries; passing the needle around, without any preliminary incision. By such a mode of procedure, there is obviously no safety for artery, nerve, or vein; and it is consequently quite unwarrantable.

Ligatures made of animal substance, as catgut, have been used, and both ends cut away; in hope of the noose becoming absorbed. Others of a metallic nature have been employed, with expectation that they would become encysted and quietly resident; as bullets and other metallic substances not unfrequently do, when lodged in the ordinary tissues. Both forms of ligature, however, have hitherto been regarded by Nature as foreign substances, and extruded by suppuration accordingly.

Pressure, without incision. In ancient times, the surgeon who was afraid to cut into an aneurism, and take his chance of arresting the flow of blood, had recourse to direct and energetic compression of the part, with the hope of cure. The name of Guattani is chiefly associated with the practice. Local sloughing, suppuration, or ulceration, with severe constitutional disturbance, yet with an unclosed artery and aneurism, resulted more frequently than a cure. Subsequently to the establishment of the Hunterian operation, however, its principle was extended to the mode of treatment by pressure; this being applied, not to the tumor itself, nor in its immediate vicinity, but at some distance; at a part such as would be selected for Hunterian deligation, in the hope of the arterial tissue there being in a sound condition.

In two ways, art may promote cure of aneurism; by retarding the aneurismal flow, and so favoring consolidation of the contents; or by aiding the textures which overlay the aneurism, and which are, as it were, continually striving to keep it down and repress its growth. The one method diminishes expansive power from within; the other increases the repressive power from without. The latter corresponds to the old method of applying pressure; the former to the modern.

This method was made trial of by Dubois, A. Cooper, Blizard, &c.; but with no satisfactory issue. The pressure was continued and severe; their object being to keep the tube close and impervious at that point, and by plastic deposit to obtain its complete consolidation. The result was, the occurrence of great pain and constitutional disturbance; followed by inflammation, ulceration, or sloughing of the compressed parts; exposing, or perhaps including, the vessel. The practice found no favor with the general profession, Lately, however, the treatment by pressure has been revived, in a more scientific form, and with a better success: conducted rather as if itself were not the agent of cure, but only the means whereby spontaneous cure may be originated and favored. The pressure is made at a Hunterian site, as before; but it is neither constant nor severe. By means of a compressor, such as invented by Signoroni (Fig. 99, p. 312)—or by means of this other instrument, adapted from a carpenter's clamp, and first suggested by a carpenter, Hoey, who was himself the subject of aneurism, and cured by this means—a moderate degree of pressure is applied to the vessel; at a point where its coats may be expected to be sound, and consequently not prone to ulcerate from slight causes. This pressure is maintained so long as it can be conveniently borne by the patient; but no longer. So soon as uneasy sensations become at all intense, with swelling and numbness of the limb, and throbbing in the part, pressure is either slackened or altogether removed. Afterwards, the parts having recovered, it is reapplied; again it is removed; and thus, by occasional and modified use, the disasters formerly attendant on treatment by compression may be altogether avoided. At the same time, circulation in and near the aneurism is decidedly moderated, so as to favor solidification. The tumor is not only arrested in its growth, but begins to diminish; its pulsation is less, and its dimensions contract; it feels harder and less compressible; ultimately pulsation wholly disappears, and induration is complete; absorption then advances, and the obliterative cure is obtained, with or without a pervious condition of the vessel.

Fig. 192.

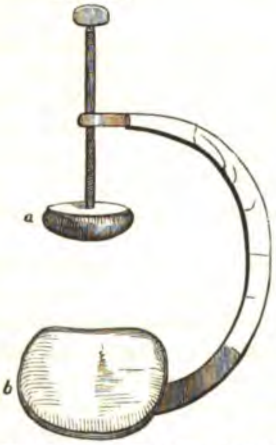


Fig. 193.

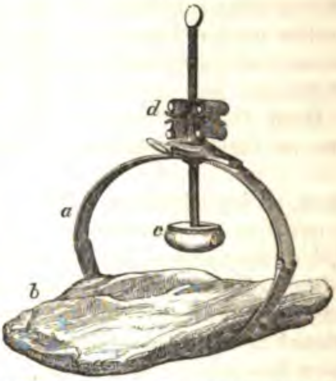
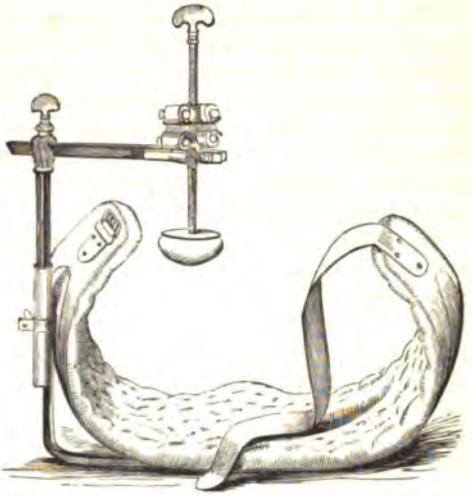


Fig. 192. The clamp, as at one time used in Dublin: *b*, the point of counter-pressure; *a*, that which compresses the artery. Fig. 193. Dr. Carte's instrument for compressing the femoral at its lower part; *a*, the metallic girth over the thigh; *b*, the pad for counter-pressure on the back part of the limb; *c*, the compressor; *d*, the elastic arrangement.

Instead of employing but one instrument, and so confining the pressure to one point, it is better to use two or more compressors—when circumstances will admit of this, as in the case of the femoral artery. One is slackened, the other screwed tight; alternately. And thus the pressure, being as it were diffused more widely, is more easily borne. Further, it is well also to diffuse the counter-pressure, by placing a splint of leather or pasteboard between the skin and pad of the instrument; the former being first covered with soap plaster.

Or the more elegant and efficient apparatus of Dr. Carte is employed; the advantages of which are the accuracy of the pressure, and the elasticity of the compressor. The artery is sufficiently operated on; while at the same time the part is comparatively absolved from irritation.

Fig. 194.



Dr. Carte's instrument for compressing the femoral at its upper part.

But even these instruments are not to be looked upon as perfect. No doubt they are doomed to give place, and that perhaps ere long, to some other yet more simple. But pressure is not trusted to alone. The same preparatory treatment is necessary as before the operation by ligature. And, throughout the whole period of treatment, absolute repose with recumbency is maintained; as well as antiphlogistic regimen, and all other means likely to favor the desired beneficial change. Also, the limb below the compresssed point should be uniformly and equably supported by bandaging, lest passive congestion and œdema supervene; and this pressure may from time to time be somewhat increased, on that part of the limb which includes the aneurismal tumor.

Let no haste be indulged in. The process is ordinarily one of weeks, not of days; gradual, not sudden; interrupted, not continually progressive. The pressure requires to be neither great nor constant; for we do not desire obliteration, even temporary, of the arterial tube there; it is sufficient to moderate, not essential to obstruct, the flow. And only by a constant remembrance that such are the principles of cure by this means, will the treatment be so leisurely and prudently conducted, as to insure avoidance of the disasters to which compression is liable.

The contemplated advantage of such a mode of treatment, when properly conducted, is immunity from ulceration and hemorrhage; subsequent recourse to the ligature, if need be, being not precluded. That is, should pressure fail, deligation is at least as likely to prove successful, as if no previous treatment had been employed. The possible disadvantages are, a protracted period, and ultimate uncertainty of cure. If improperly conducted, compression is in every point of view inferior to ligature; not only less certain of cure, but also even more certain of danger at the selected part of the vessel. And it need cause no surprise should unfortunate cases occasionally occur. But, when well managed, pressure bids fair to supersede ligature, in at least many cases of external aneurism; especially the popliteal.

The leading points of the method may be again stated. The pressure is at some distance from the tumor; moderate, and regulated according to the feelings of the patient. It is not necessary, and it is not our object, to obliterate the vessel at the compressed point. In other respects the same treatment is followed out, regarding both part and system, as in favoring spontaneous cure without any surgical interference (p. 517).

The first successful case of the modern use of pressure occurred in the practice of the late Mr. Todd of Dublin, in 1825. But the method then fell again into desuetude; until once more revived, in 1842, under more favorable auspices, by Dr. Hutton, of the same city. Mr. Cusack, Sir P. Crampton, Dr. Bellingham, and others, followed; also with success. Mr. Liston, with other London surgeons, became converts to the practice; and now, prejudice against it seems to be gradually giving way throughout the whole profession.

In 1846, twenty-nine cases of aneurism had been so treated: six femoral, and twenty-three popliteal. In twenty-five of these cases, cure was complete, and in all respects satisfactory. In four, the artery was tied; "chiefly from want of confidence in pressure, on the part of either surgeon or patient." In none was there any accident to life or limb. And in contrast to this, it is interesting to refer to a table, constructed by Mr. B. Phillips, of 171 cases of aneurism affecting the larger arteries, in which the Hunterian operation was performed. Of these fifty-seven were unsuccessful; all the patients, except two, having died; not of the disease but of the operation. And among the successful cases, secondary hemorrhage occurred fifteen times.[1]

An equally interesting document is furnished by Dr. Norris, of Pennsylvania.[2] He has arranged, in a tabular form, all the recorded cases of ligature of the femoral artery; and the following striking results appear. Of the 204 examples of Hunterian deligation applied to this vessel, fifty died; and six of the patients who recovered underwent amputation in consequence of gangrene of the limb. In 188 of the cases, the operation was performed on account of aneurism; and of these forty-six died. In one of the successful[3] cases, the aneurismal condition was reproduced, nine months after recovery from the operation; and cure was completed by compression. In another successful case, the tumor returned after the lapse of four years, and the patient died after amputation. In a third successful case, pulsation returned in the tumor, nine months after the operation; and cure was completed by "cold and compression." In an unsuccessful case a double femoral was found after death, while only one of the vessels was secured by ligature. In a successful case, it is stated "the patient recovered, but was not cured;" the tumor remaining "stationary, with the same pulsation," a year after the operation. In another successful case, the tumor reappeared after six months; and was then cured by compression. In another successful case, pulsation was observed in the tumor five months after the operation; the sac then suppurated, and cure followed. In another, "the tumor had returned to nearly its original size and force, five months after the operation;" and cure was completed by compression. In another, a second operation, at a lower part of the vessel, was required six months after the first; this having failed to affect the tumor. And, in addition, a case is mentioned (not in the table) in which amputation was performed for a popliteal aneurism, which ligature of the femoral, twelve months previously, had failed to cure. In five of the cases, phlebitis proved fatal; in three, tetanus was the cause of death. In twenty-four hemorrhage occurred; of these twelve died; and one of the recovered lost his limb by amputation. In sixteen cases the sac suppurated; six of the patients died in consequence; and again one of the recovered suffered amputation. In thirty-one cases, gangrene of the limb occurred (in all the artery had been tied on account of aneurism); of these twenty-three died; and those who recovered of course retained life only at the cost of the limb's loss by amputation.

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[1] Dublin Journal of Medical Science, May, 1843, p. 364. Lancet, 1052, p. 106. *Ibid.* 1073, p. 24. *Ibid.* 1105, p. 157. *Ibid* 1186, p. 574. British and Foreign Review, Oct. 1845, p. 436. Braithwaite's Retrospect, vol. xi, p. 177. Dublin Quarterly Journal, Aug. 1846, p. 104. Bellingham on Treatment of Aneurism by Pressure, Dublin, 1845. Tuffnell on the Treatment of Aneurism by Compression, Dublin, 1851. Association Medical Journal, April 22, 1853, p. 344.

[2] American Journal of Medical Science, Oct. 1849, p. 314.

[3] The term "successful" is applied to those cases where death did not occur in consequence of the operation.

At the end of Dr. Norris's paper, he inserts a table of thirty-seven cases of femoral and popliteal aneurisms treated by compression since 1842. Of these thirty-five were satisfactorily cured. Of the remaining two, one underwent the operation by ligature, after compression had failed; the other "died suddenly from disease of the heart, forty-eight hours after pressure had been removed. All pulsation had ceased."

No doubt, some surgeons have experienced remarkable success in tying particular arteries. Mr. Syme, for example, has been very fortunate with the femoral. But it is more than probable that, as in similar sequences of success in lithotomy, and other capital operations, the progress of time will include disastrous cases, which will not fail to bring down the result to a more ordinary average.

In tying an aneurismal artery, no skill in the operation can altogether avert risk.—Of phlebitis; for the vein usually is in immediate apposition with the artery, and must be exposed to some roughness of manipulation. —Of gangrene; for impression of the limb's circulation is inevitably both great and sudden.—Of hemorrhage, above all; for the artery tied is necessarily more or less altered in structure and function, and consequently prone to the asthenic results of inflammatory change. Had there been no chronic arteritis, there had been no aneurism. Pressure, unskilfully and rashly applied, is at least equally capable of causing these risks. But pressure employed according to the principles now enjoined, in its modern revival, escapes them all.

My own experience of pressure has been but limited. In one case only have I had an opportunity fairly of putting it in practice. The aneurism was popliteal; and, according to the patient's account, had been but three weeks in existence. It filled the whole popliteal space; and was rapidly enlarging. Pressure was applied to the femoral, by means of two compressors;[1] alternately slackened and tightened. And, at first, the result was most encouraging; the tumor becoming smaller, hard, and less pulsatile. After some days, however, pressure had become intolerable to the patient; and the tumor, freshly pulsating, had begun to enlarge more rapidly than ever; pushing upwards in the thigh, and growing more and more superficial. The limb beneath too, had become painful and swollen; and, under all the circumstances, I considered it prudent to perform deligation. This accordingly I did, a fortnight after compression had been first begun; experiencing no obstacle from the effects of previous pressure. The textures presented their ordinary characters; and there was no difficulty in making the necessary isolation of the vessel. The cure was satisfactory. And the case will certainly not deter me from again making trial of pressure, under more promising circumstances.

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[1] Signoroni's. Not so good as even the simple clamp; and much inferior to the instruments now in use.

In another case, of low femoral aneurism, I intended to make trial of compression; the patient being obviously affected with the aneurismal diathesis, and in consequence unsuited for operation by ligature. In the early application of the compressor, however, the skin became ruffled; and while waiting till that should heal, the tumor suddenly became diffuse, gangrene of the limb followed, and amputation of the thigh became necessary. The patient made an excellent recovery till the third week, when the stump was almost healed; then symptoms of pyæmia set in; and under these he quickly sank.

In a third case, one of high axillary aneurism on the left side, with dilatation of the artery above the clavicle, and in which the attempt at cure by deligation, as it seemed to me, must have proved certainly and rapidly fatal, I made trial of pressure, with varying prospects of success, but with ultimate failure.

These cases by no means tell unfavorably on the mode of cure employed, as some interested parties have hastened to allege. An impartial observer will be satisfied that, in the two last, pressure failed only where ligature would have proved still more manifestly unfortunate.

That pressure is to supersede ligature altogether, in the treatment of aneurism, no one can imagine. Some patients, by idiosyncrasy, may be intolerant even of such modified pressure as is required; and to some aneurisms the application of it is impracticable. There seems every reason to anticipate that the result of experience will determine that some aneurisms are unsuitable for either deligation or pressure; absolutely incurable, by reason of universal and extreme arterial degeneration. And that, of the curable cases, some are suited for pressure, others for deligation; just as, in stone, patients are not indiscriminately subjected to lithotomy as in former years, but while some are cut, others have the calculus removed by lithotripsy; neither operation being exclusively followed in the practice of any wise and thoroughly accomplished surgeon. And further, it will no doubt appear that there are certain cases of aneurism, in which it were both unwise and unwarrantable to operate by the knife, when experience has shown that pressure will suffice; just as we should be culpable in removing a stone by wound of the bladder, which experience tells us may be safely crushed, or removed by the urethra entire.

In reference to this subject I have much pleasure in inserting a communication from Mr. Cusack of Dublin; a surgeon whom all must admit to be amply experienced, and in every way specially qualified to judge. The date is December 27, 1849. "I cannot more fully convey my opinion of the value of simple pressure as a means of cure in aneurisms of the extremities, than by just stating that I have not operated by ligature, either on the femoral or brachial artery, during the past six years; and that if my nearest relation, or any friend, were unfortunately afflicted with popliteal aneurism, I would not hesitate to use pressure in preference to the operation by ligature."

Mr. Cusack also has communicated to me the notice of dissection in the case of a patient who had been cured of aneurism by pressure in October, 1843; and who died in December, 1850 of diseased brain. The femoral artery was pervious, and of ordinary size, down to the site of the tumor; there its cavity was obliterated, and its coats flattened out into the form and appearance of a ligamentous band. The obliteration extended to about two inches and a quarter, occupying the last inch of the femoral, and the upper one and a quarter inch of the popliteal artery; beneath this point the vessel again becoming pervious, and nearly of its natural size. The profunda and its branches were of ordinary bulk; and the branches of the popliteal were not above the usual dimensions. The vein accompanying the main artery was full of blood, but quite pervious, from the groin down to the lower extremity of the popliteal space. Its external characters were normal throughout; excepting just opposite the obliterated portion of the artery, where the coats of the vein were much thickened and indurated. The internal saphena vein was large, and filled with a fibrinous clot.

In this case the points of pressure had been in the upper and middle thirds of the thigh, alternately; and it is most satisfactory to have such ample proof of the curative agent having produced no evil effect whatever on the vessels directly implicated.

One point in connection with this mode of treatment is not to be forgotten. In two of the recorded successful cases,—one treated by Mr. Porter, the other by Mr. Cusack—coagulation of the aneurismal contents, and commencement of the ultimate cure, took place several days after apparent failure of the compression. And, in a case of brachial aneurism, treated by Mr. Cusack, *which had been reported unsuccessful*—pressure having apparently failed—it was discovered that "very soon after she left the hospital, the beating entirely ceased; and there is now a very small, and exceedingly hard little tumor, almost cartilaginous, at the seat of the old aneurism." Hence it is deduced, as a practical rule, that when pressure seems to have failed, and the tumor perhaps shows unwonted excitement, we are not at once to proceed to operation by ligature. Ultimate cure may be already in progress.

That general vascular excitement, with apparent aggravation of the tumor, should be followed by cure, will not appear so extraordinary when we reflect, that the inflammatory state is necessarily connected with increase of fibrin in the blood—a state favorable to coagulation (p. 110). At the same time, it is to be recollected that when inflammation has invaded the cyst, the latter in consequence has become lacerable; and that diffusion of the aneurism is, in consequence, more probable than before.

Cold has been applied continuously to the tumor; in the hope tha contraction of the cyst and solidification of its contents would be thu favored. The contemplated advantages, however, are not obtained; an danger by gangrene is rendered imminent.

The insertion of a *seton* has been tried; and there is no need t repeat the experiment. The certainty of danger incurred is not compensated by the probable advantage.

The application of galvanism, by *acupuncture*, offers good results, in certain cases. This method of cure was first proposed by Mr. B. Phillips in 1832. Afterwards, it has been successfully prosecuted by MM. Petrequin, Ciniselli, Abeille, and others. The object is to produce coagulation of the aneurismal contents; and the agent for effecting this—galvanism—is passed through by means of needles; which are partly covered with a layer of gum-lac varnish, to protect the ordinary tissues which they have to traverse. The needles having been lodged in the tumor, and retardation of the aneurismal circulation having been effected by temporary pressure above, the galvanic current is set on, of such strength as the patient is able to bear; anæsthesia being employed, or not, as circumstances may seem to require. "To succeed in coagulating the blood, it is necessary to introduce the needles at opposite points, so that they may correspond with each other—to place them in an oblique or perpendicular direction to that of the blood, in order to oppose a barrier to its course—to cross them, in order to render their influence more active—and to multiply them in large aneurisms, so that a certain number of clots may be early produced, sufficient to act as a framework for the whole coagulum. It is also advantageous to change the direction of the currents many times, so that the galvanic fluid may act in every way, so as to produce a multitude of filaments that will extend as a meshwork through the sanguineous mass. In difficult cases it is necessary to continue the galvanic action a long time, better to insure success, even repeating the electric applications at successive sittings."[1]

Patients who are intolerant of pressure, and are hostile to knife and ligature, have by this means a fair prospect of obtaining cure of aneurism. Watchfulness is necessary, however, lest over-excitement be induced, and suppuration or even gangrene threaten. Under prudent and cautious management such risks are not likely to occur; but with imprudent haste, they are far from improbable.

Injections into the sac have been made trial of, as of tannin, tincture of the muriate iron, &c., with a view to determine rapid and effectual coagulation of the aneurismal contents; as yet, however, with something considerably less than success in the object aimed at.

Amputation—not unfrequently resorted to in this disease by the old surgeons—is still preferable to all other modes of treatment, under certain circumstances. 1. When bone has been hopelessly involved, during progress of the tumor. 2. When the diffused form of aneurism has occurred to a great extent; so that absorption and consolidation cannot remedy the evil, and great as well as extensive inflammation must occur in the infiltrated tissues. Even supposing the aperture in the vessel to have been closed, suppuration and hectic would be certain ultimately to demand amputation. And should the aperture remain unoccluded, danger to life by hemorrhage would occur at an earlier period; with the first evacuation of purulent fluid. 3. When disease of the vein coexists; impeding venous return. If by pressure or deligation, in such a case, we at the same time impede arterial influx—although only imperfectly, or for a time—it will be difficult to avert the occurrence of gangrene, as a direct and almost immediate result. Amputation would be demanded, on account of spreading gangrene; under circumstances which afford but slender hope of success. It were better to amputate at once, and anticipate disaster. 4. When a large aneurismal sac has suppurated, in a patient already weak. Suppuration of the entire cyst is one of the modes of spontaneous cure. When the suppurated surface is of no great extent, secretion not profuse, and the frame robust, the cavity usually fills up and consolidates. But if the surface be large, secretion great, and the system already worn, hectic is almost certain to occur; of so formidable a nature as to demand sacrifice of the limb, in order to save life. 5. When from any cause, gangrene threatens; of the limb; not of the tumor only—for this latter, as formerly explained, may prove the means of a spontaneous cure (p. 496).

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[1] British and Foreign Review, No. xlviii, p. 419; Monthly Journal, Aug. 1846, p. 150; *Ibid.* Nov. 1846, p. 374; *Ibid.* Jan. 1848, p. 521; *Ibid.* May, 1848, Retrospect, p. 89.

Casualties of the Operation.

We now come to consider the casualties that may attend on the ordinary operation by ligature. And the foremost of these is hemorrhage.

Secondary Hemorrhage.—This may be variously induced. 1. By sloughing of the arterial tissue. The artery has been too freely and extensively detached from its surrounding connections; it loses both its mechanical support, and from imperfect nutrition, its vital power. A certain amount of the inflammatory process necessarily follows the injury done in operation; there is no sufficiency of power in the inflaming part to resist or control; it perishes; and, on separation of the slough, a gush of arterial blood discloses the open condition of the artery. Thus is occasioned the earliest form of bleeding; occurring within a few days after the operation. A large space of vessel being usually opened, the flow may prove at once fatal. More frequently, however, it remits; and by repetition exhausts the patient.

2. By ulceration at the time of the ligature's separation; usually between the tenth and twentieth days. How this may occur has already been explained; from want of plastic exudation, on the one hand; and from proneness to ulceration on the other. It may be the fault of the artery; the coats at the deligated point being so degenerated, as to be quite incapable of the required salutary change. It may be the fault of the operation; the coats having been too much detached; not enough to induce sloughing; but quite enough to carry the inflammatory process beyond the stage of plastic exudation, into that of suppuration and ulcer. It may be the fault of the ligature; too broad and clumsy in its nature; not dividing the internal coat, so

as to permit resilience and coaptation of the cut surfaces, favorable for adhesion; and, by necessarily producing a large slough of the included tissue, rendering a proportionally great amount of inflammation and ulceration necessary for detachment. Or it may be the result of accidental circumstances, over the accession of which we have little or no control; as erysipelas, purulent infiltration, febrile disorder, &c. Practically, it is important to observe, that in this form of bleeding the flow is, in the great majority of cases, from the distal side of the ligature. There, doubtless, the vital power of the tissue is more depressed than on the opposite aspect; for the immediate effect of tightening the ligature will plainly be, to interfere with both nervous and vascular supply in that part of the arterial tissue. On both ides, inflammation and ulceration must ensue; to detach the noose and included slough. And on that side, where power is least, the morbid process will be most rapid and extensive; while surrounding plastic exudation is most defective. On the distal side, the coats are likely to ulcerate more rapidly and widely than on the cardiac; and while on the latter aspect the tube is shut, at and beyond the line of ulceration, on the former it may be open and ready to bleed.

3. Or hemorrhage may be altogether independent of the ligature's separation; occurring either before or after that event; more frequently after. Abscess forms in the tissues around; it enlarges, and includes the vessel; plastic exudation is interrupted; by pressure of the abscess ulceration is effected in the arterial coats, from without (p. 187); and the pervious canal is opened—it may be above or below the ligature, according to circumstances. Were the practice followed as advocated by some, of cutting off both ends of the ligature after its application, and were the wound to adhere completely in its external part by adhesion—it is very plain that this casualty would be rendered very probable. The noose would act as a foreign substance; after, as well as during and before its separation from the living arterial tissue. It would become the cause and centre of an acute abscess. That abscess, cooped up and confined by closure of the external wound, would by extension implicate the vessel more and more, and too probably at length effect an ulcerated aperture into a pervious portion. By this time the external wound has again opened; or it may have been but partially shut; and the hemorrhage is free.

Secondary bleeding by ulceration is often preceded by marked febrile accession; a circumstance of no little interest to the practitioner, as forewarning him of the coming danger. Sometimes enabling him to avert it altogether; in all cases preparing him to meet the emergency. Secretion is arrested, the pulse becomes full and throbbing; the head is pained, the face flushed. The patient is restless, anxious and alarmed; and complains of a tightness about the chest. Then comes the hemorrhage. "When unexcited he lies pale and exsanguine, yet at the same time excessively irritable and anxious; but whilst under the influence of the febrile paroxysm, his face is flushed, his skin hot and dry, his pulse tight and bounding, but affording a peculiar sensation resembling a double beat; and it is during a period of such exacerbation that each successive hemorrhage occurs."[1] Such fever is seldom absent, when hemorrhage has taken place, and continues by repetition (p. 326). But the first occurrence is sometimes preceded by no febrile state whatever: the flow coming without any warning; perhaps seeming to be induced by some movement of the patient, in changing posture.

The bleeding may spontaneously cease. More frequently, however—and sometimes even when active and suitable treatment has been employed—it recurs once and again. And the patient dies exhausted; partly from the direct effects of loss of blood; partly from the disorder of system which the exsanguine state has induced.

Treatment.—In the first instance let it be prophylactic. The preliminary febrile paroxysm is marked and met. Bleeding from the arm is practised, if not otherwise strongly contraindicated; of such an amount, and so abstracted, as to produce a decidedly sedative effect on the heart's action, and on the general circulation. And this sedative effect is maintained, by subsequent exhibition of a full opiate. Thereafter, aconite or belladonna may be advantageously used; to prolong and perhaps increase the beneficial effect, which bleeding and opium in the first instance induced. By thus calming the tumult of circulation, at the suspected point as well as elsewhere, an additional opportunity may be afforded for occlusion by suitable exudation; ulceration having ceased. Or if bleeding do occur, it will be in a comparatively moderate and diminished flow.

When the dreaded casualty has taken place, treatment varies according to the nature of the cause. 1. If it be according to the first, as formerly stated (p. 515), we need have no hesitation in tying the vessel afresh, at a higher point; if that be in our power. And at the same time, pressure is to be applied to the bleeding orifice; exact, direct, and graduated; by means of compress and bandage (p. 311). As a general rule, it may be here stated that the pressure, if exact, need not and ought not to be severe. Exactness, combined with moderate intensity, will be sufficient to arrest the flow, and to induce fibrinous exudation to fill the chasm. A higher force would not be more effectual as a hemostatic, and would probably cause renewal of ulceration or sloughing in the compressed arterial tissue; occasioning repetition of the casualty by renewal of its cause.

2. In the second form of secondary hemorrhage (p. 515), if we are certain that the bleeding comes from the distal aspect of the ligature, as in most cases it does, little benefit need be expected from an additional ligature on the cardiac aspect; and this procedure, therefore, is not adopted in the first instance. The wound is cleared of coagulum, and enlarged if necessary, so as to expose completely the bleeding point; and this is overlaid by a graduated compress, retained so as to exert that degree of pressure which we have just seen to be most expedient; the rest of the limb being duly supported by bandaging. In many cases, this will succeed; when conjoined with general treatment suitable for maintaining gentleness and tranquillity of circulation. Should it fail; then, as a last resource, let a fresh ligature be placed on the cardiac aspect, by a fresh wound; while pressure is maintained as before. The second ligature may succeed in stanching the flow; but, in its turn, it may prove the cause of a second bleeding, by recurrence of ulceration

at the newly deligated part. Let there be no despair, and inactivity in consequence. So long as space permits, let ligature follow ligature on the cardiac aspect; and it is quite possible that in the end success will still be ours. Examples of such perseverance in surgery, well rewarded, are by no means unfrequent.[1]

3. In the third form of secondary hemorrhage, let the abscess be speedily evacuated. Then if there be room, place a ligature on the cardiac side; and maintain direct and moderate pressure, over the bleeding point. If second deligation be impracticable—as too often is the case, this form being most frequent in the deep-seated vessels, as those at the root of the neck—pressure must be trusted to alone, along with general treatment.

Phlebitis.—Another casualty, s[illegible]ss alarming, may follow deligation; inflammation of the concomitant vein. If the phlebitis be of the worst kind—diffusely suppurative—this of itself at once perils existence. And, supposing only the simplest form to occur—that which terminates in thickening of the coats, and occlusion of the canal at the point affected—gangrene is rendered probable; pervading the whole limb, and demanding amputation. This danger should ever be borne in mind when conducting the operation. The vein should be studiously avoided, and left undisturbed; by forceps, fingers, knife, and ligature. As already stated, it is of much importance, as regards the artery itself, that its tissue alone should be included in the ligature's noose. And as regards the success of the operation, it is not less important that the surrounding tissues should be uninjured; and of these most especially the vein. Phlebitis, once excited, under such circumstances, will scarcely be within our control, so as to avert the evil consequences.

It may happen that, some days after the operation, both patient and practitioner are alarmed by sudden occurrence of strong pulsation in the wound; not connected with the state of either the artery or the aneurism, but entirely muscular; intermittent, and not synchronous with the arterial pulse. Alarm on such ground is unnecessary. In a short time, some simple antispasmodic having perhaps been given, and quietude maintained, the normal state is restored.

Treatment of Aneurism beyond the reach of Surgery.

Not unfrequently, aneurism is so situated as to be amenable neither to pressure, nor to deligation of any kind. In such cases, the issue is likely to prove untoward; the disease continuing to advance, till death ensue by one or other of the methods formerly noticed (p. 491). Yet there is hope of spontaneous cure. And, further, we have means in our power whereby that event may be favored; the science, not the art of healing, being brought into play. Our object is to oppose the tumor's increase, and favor its becoming consolidated and impervious. The obvious mode of accomplishing such an end, is to moderate circulation in general; at the same time promoting coagulation in the part. General bloodletting is advisable; but not to excess, otherwise tumult by nervous reaction will result. A full bleeding is taken from the arm, but not to actual syncope (p. 140); and is followed by an opiate. The sedative effect of a full bleeding is desired; and it is probably of some consequence also to diminish, even temporarily, the actual bulk of the circulating fluid. Aconite or belladonna will be useful in maintaining the state of depression; the dose being, of course, regulated by the effect produced. Food is scanty, simple, nutritious, and non-stimulant; sparing, in order not to restore full-bloodedness; simple and sparing, so as not to excite the circulation; not too meagre, otherwise a thinness of blood will result, very unfavorable to the occurrence of coagulation, and consequently hostile to not the least important indication of cure. A due proportion of fibrin is essential; and nicety of management is plainly necessary to secure this, yet maintaining gentleness of circulation. Acetate of lead with opium may be given internally, in sustained doses; tending both to moderate the blood's flow, and to induce coagulation, where the current is most sluggish—within the aneurismal cyst. Digitalis, colchicum, and other sedatives to the circulation, may also prove of service. Regulation of the bowels is not to be neglected; but all drastic purging should be abstained from. For, though at first a sedative effect may be thus obtained, excitement of the circulation is almost sure to follow. Repose of both body and mind is carefully enjoined. The nature and object of the treatment are explained to the patient, and his intelligent, yet not over-anxious co-operation is thus secured. By long, patient, and skilful perseverance, he may be rewarded by a cure; but, unfortunately, even under the best management, this is rather the exception than the rule.

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[1] Amongst others the following:—London and Edinburgh Monthly Journal, vol. i, p. 336. *Ibid.* vol. iii, p. 109.

Treatment of False Aneurism.

The most common form being the result of wound in venesection, at the bend of the arm, to that our attention may be directed.

Prevention of the aneurismal formation is in our power; if the case be seen at the moment of injury, or even soon thereafter. Firm pressure is made with the thumb over the puncture, while an assistant is busy encircling each finger of the wounded member separately in a bandage; these bandages meet in the palm; and a roller is then carried from the hand upwards, until the site of puncture is reached. A graduated compress of lint is placed accurately over the wound; the compressing finger or thumb being cautiously removed for this purpose. And the compress is retained securely in its place by the roller; bandaging being made considerably tighter there, than on the rest of the limb. Energetic pressure, as well as accurate, is required; and the previous bandaging permits us to exert that with impunity. Without uniform support of the whole limb, even moderate compression cannot be borne safely for any length of time. Gangrene has ensued from the omission (p. 240). The dressing is retained, in a state of firmness and efficiency, for several days; when it may be reapplied somewhat more slackly. But it should not be altogether discontinued for two or three weeks. Our object is to shut the arterial canal entirely, at the wounded part; both temporarily and permanently; first by mechanical apposition, afterwards by fibrinous exudation. And thus all aneurismal formation is manifestly frustrated. Pressure being accurate and effective from the first, there is no infiltration or accumulation of blood in the areolar tissue, and no condensation of that into a containing cyst. No evil consequences are likely to follow such obliteration of the vessel at the injured part; and consequently it is a needless refinement in surgery, to attempt closure of the arterial wound only, by a more delicately conducted pressure. During such an attempt, it is more than likely that blood will escape from the puncture, and the aneurismal tumor will become duly established.

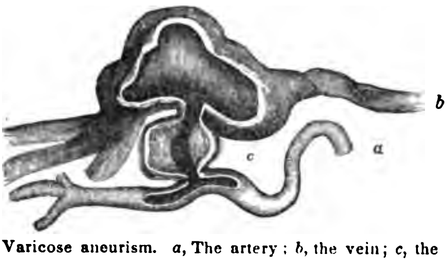
Should pressure fail, or should no opportunity have offered for its employment, the tumor certainly forms. It is then to be dealt with by operation; by one of two methods, according to its character and period of duration. If it have existed long—for several years—and be of large size, and only partly compressible, it may be treated as a true aneurism; by deligation, on the [illegible] principle. The humeral is tied; pressure being at the same time employed directly on the part; applied in the same way as for prevention, but with much less intensity. If, however, the tumor be recent, soft, and compressible, it is to be treated be direct incision. And this is the form which is most frequently presented; the patient being naturally alarmed by the pulsating swelling, and anxious that its growth should be arrested.

A tourniquet, or the fingers of an assistant, having been applied to the humeral in order to restrain hemorrhage temporarily, a free incision is made throughout the whole extent of the cyst; avoiding the superimposed vein. The coagulum is turned aside, and the aperture of communication in the arterial coats looked for; if obscured, a slackening of pressure above gives a jet of blood, which will readily disclose the site. By means of the knife's point, the artery is carefully detached from the surrounding parts; the venous tissue being especially avoided; and a ligature is passed accurately, above and below the punctured point. A full-sized probe, introduced into the aperture, renders the arterial tube more distinct, and facilitates its isolation by dissection. If the cyst be large, dense, and compact, it may be dissected away, either in whole or in part; the wound being then more favorably disposed for healing, without much, if any, suppuration. Then pressure is removed. The wound is approximated; one end of each ligature protruding. And the treatment is conducted with a view to adhesion.

Varicose Aneurism.

A variety of false aneurism sometimes occurs, termed *Varicose Aneurism.* The punctured aperture remains pervious in both vein and artery; the vein having been transfixed, and its superficial wound alone closing along with the integumental incision. The aneurismal cyst forms in the usual manner, but with a double communication; deeply, on the posterior aspect, with the artery; superficially, with the vein. In consequence, there is a mal-adjustment of the circulation [illegible]; arterial blood

Fig. 195.

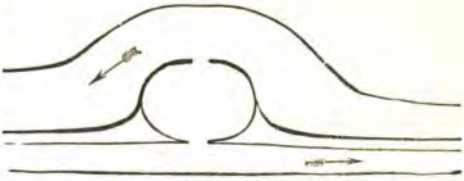


Varicose aneurism. *a*, The artery; *b*, the vein; *c*, the intermediate cyst.—SIR C. BELL.

making good an entrance into the vein, whereby distension of the latter occurs to a greater or less extent. The symptoms are the same as in the ordinary tumor; with the addition of varicose enlargement of the vein, and unusual activity of circulation within it. A peculiar thrill and bruit are at the same time readily perceptible by finger and ear; compared by some to the noise of the fly-wheel of a musical box, by some to the purring of a cat, and by others to the buzzing of a fly confined in a paper bag; once observed, easily remembered. In other words, the aneurismal bruit is unusually distinct and palpable.

Treatment is the same as for the ordinary form of false aneurism; deligation; either direct or at a distance on the cardiac aspect, according to circumstances. Sometimes it may be practicable to tie the artery above and below its aperture of communication, by lateral incision and dissection; leaving the sac and dilated vein intact.

Fig. 196.



Outline of varicose aneurism.

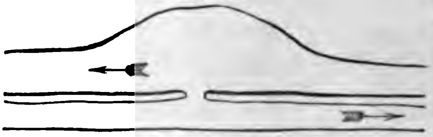
A similar condition may be the result of ulceration. Suppose an artery and vein in juxtaposition; as the abdominal aorta and vena cava. An aneurismal pouch begins to form in the artery, and extends in the direction of the vein; the cyst becoming incorporated with the venous coats. Ulceration occurs in both tissues; and an aperture more or less free, is established between the two vessels; entailing a constant and free commixture of their contents. Such a condition of parts, so situated, is plainly irremediable. Spontaneous cure, by occlusion of the aperture, and consolidation of the cyst, is possible, but not probable. Usually the result is fatal; by disorder of the general health, which the faulty circulation cannot fail to produce.

Aneurismal Varix

Is a second variety; and may also occur at the bend of the arm. The artery and vein communicate, as in the former case; but without any cyst interposed; the artery playing directly into the venous cavity. The swelling is less, but more diffused; the circulation is more plainly tumultuous; thrill and bruit are more or less distinct, according to the size of the communicating aperture; varicose distension of the vein is great. Painful sensations, with some interstitial swelling, attend on the first formation. But these subside gradually, and usually, at length almost wholly disappear; the morbid state remaining in all respects stationary. The limb below the tumor is imperfectly supplied with arterial blood; a portión of the artery's contents entering the vein, and returning to the heart; the limb consequently is cold, numb, and vitally weak. By obstruction to venous return, also, passive congestion and œdema are likely to ensue; at least for a time. By and by, collateral circulation having become fully established, both arterial and venous, a healthy condition may be almost completely restored.

In consequence of this comparative absence of inconvenience and growth, the case cannot be regarded as one demanding operative interference. Pressure is sufficient; to repress swelling, and to moderate, if not prevent, sanguineous intermixture. We have no hope of so occluding the aperture. Palliation is our only object; repressing growth, removing uneasy sensations, and permitting use of the limb. Should, however, a case occur of unusual urgency, and the patient become dissatisfied with merely palliative treatment, a direct incision may be made on the artery; and, a cautious dissection having separated its coats from the surrounding parts, above and below the aperture of communication, a ligature may be passed and secured at each of these points. The affection itself is rare; and, still more so, are examples of urgency sufficient to render such operative interference even expedient.

Fig. 197.



Outline of aneurismal Varix.

ANEURISM BY ANASTOMOSIS; VASCULAR, OR ERECTILE TUMOR.

This might have been classed with tumors, and considered along with them. Yet it comes naturally in connection with diseases of the arterial tissue. The term denotes a diseased formation, in which the vascular tissue bears the most prominent part.

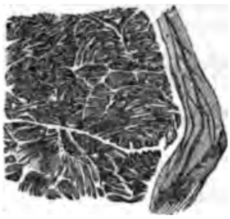
There are varieties of such adventitious structure. 1. The capillaries of a portion of integument may be equably and permanently dilated; producing discoloration, and but slight elevation of the affected part. Bleeding is copious from any breach of its surface; by ulcer, or by wound. This is one form of nævus, or congenital mark; an affection of no danger, and but little inconvenience. It may be looked upon as rather a deformity than a disease.

2. The structure may consist chiefly of dilated veins; not over-distended and merely passive tubes, as in varix; but retentive of tone, and energy of function; fed by arterial branches, of somewhat corresponding size and activity; yet the latter tissue holding but a comparatively subordinate part in the development of the tumor. This morbid structure is not found in the substance of the true skin, like the preceding, but in subjacent areolar tissue; of various size and prominence; causin a doughy elastic swelling, of a livid hue—venous structure appearin with tolerable distinctness through the superimposed integument. I breach of surface take place, hemorrhage is profuse, and chiefly of th venous character; capable of being arrested by pressure, without muc difficulty. If an incision pervade the mass to any considerable exten arterial branches may be found spouting with much activity; but sti the main stream is dark and venous. Or the tumor may be submucou as exemplified by one kind of hemorrhoid—situated partly within a partly without the verge of the anus.

3. The third form of swelling is composed of dilated bloodvessel which, closely crowded together, open into each other at many point These openings may be of secondary formation; the result of clo

apposition in the dilated vessels. Or, more probably, they are primary; the structure consisting of a network of dilated capillaries; the openings of comunication being the ordinary and original inosculations, and what were intervascular spaces being now condensed into mere fibrous bands. The whole constitutes a vascular network of great capacity and activity of circulation; supplied for reception of the returned blood with large and tortuous veins, whose lining membrane is plainly continuous with that of the abnormal vascular cells.[1] Also, in the neighborhood, are to be found the feeding arteries; originally perhaps twigs, now enlarged to trunks; pulsating strongly, and obviously carrying on a plentiful and active supply. The mass may be subcutaneous; constituting the true aneurism by anastomosis or erectile tumor; varying in bulk and tension, according as the circulation is sluggish or excited; compressible; elastic to the touch, and indicating its tubular structure on being pinched or rubbed when in the flaccid state; of a reddish hue; in some parts tending to livor, but not continuously so, as in the preceding form of tumor. Or it may be submucous; constituting the most frequent form of internal hemorrhoid. The structure is analogous to normal erectile tissue; but with this difference, that whereas in the normal, there are periods of complete repose and collapse, tension and fulness occurring but occasionally by local determination—in the morbid there is never utter flaccidity and repose. The tumor is more full and tense at one time than at another; yet at all times it is full and active; evincing an undulatory movement, if small; when large it may be found pulsating, strongly and with bruit, as in ordinary aneurism.

Fig. 198.



Section of erectile tumor.—*Cyclopædia of Anatomy and Physiology.*

Strictly speaking, there is no aneurism here; but rather a simple exaggeration of vascular tissue and function; no degeneration of coats, but simply dilatation; and yet not dilatation alone, but corresponding increase of function as well. The morbid formation may supervene at any period of life; but most frequently it is congenital; and, growing faster than the normal structures around it, claims our attention at an early age. The most common situations are, beneath the integuments of the face, head, neck, back, and buttocks; not unfrequently it forms on the hands and feet. The tumor pulsates, synchronously with the heart's action; but much less distinctly, and with less expansion, than true aneurism. It may be considerably diminished by equable and sustained pressure, resuming its wonted bulk on removal of the pressure. A bruit is heard; dull, and rough; and sometimes associated with a vibratory thrill. At first the skin is free; ultimately it becomes involved in the morbid structure, and incorporated with the general mass. Sometimes the growth is slow; sometimes, and more frequently, rapid. In all cases, bulk is temporarily increased by mental excitement, muscular exertion, and whatever suddenly and much excites the circulation.

The tumor having become superficial by involvement of the skin, ulceration is likely to occur; and hemorrhage follows; profuse, and not easily restrained; demanding active interference, otherwise by repetition or continuance it may exhaust the patient. Or ulceration may have a salutary result. If surrounded and preceded by fibrinous exudation, the vascular structure may be consolidated; no bleeding taking place, even from an acute and wide ulcer. And this consolidation advancing as the ulcer spreads, so as invariably to precede and surround the breach, the adventitious structure may be altogether got rid of; partly by obliteration, partly by ulcerative loss of substance. Sometimes hemorrhage is vicarious in the female adult; taking the place of the menstrual discharge. The tumor becomes tense and full at the return of each period; a small fissure, or sore, forms in the skin; and from this the blood slowly distils. Such bleeding is seldom dangerous, or even excessive; and is not to be suddenly arrested, without means having been duly taken to secure regularity of the normal discharge.

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[1] A full description of an example of this tissue is given by Mr. Goodsir in the Edinburgh Monthly Journal, May, 1845, p. 342.

Sometimes the tumor, after even rapid growth for a time, comes to a stand; and remains stationary, or even slowly decreases in both size and activity. Such cases, however, are rather exceptional than otherwise; and the event may not be safely trusted to in practice.

The tumor may also degenerate (p. 265). That is, it may change its character, and become of a worse kind than at first. Medullary or melanotic matter may be deposited in and around it, or come altogether to takes its place—the original character of the growth being entirely lost. This I have seen occur in an erectile tumor of the cheek (p. 294).

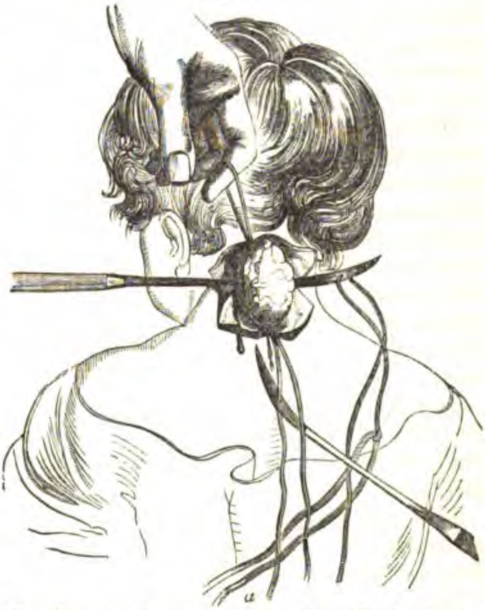
The third form of the affection, or true erectile tumor, is obviously not a mere deformity; but a disease of much importance, tending by growth and casualties to bring life into peril. The question of *Treatment*, therefore, is not devoid of interest. It may be conducted on three different principles. 1. *By removal of the morbid structure.*—Excision, so applicable to tumors in general, is inexpedient; the extent and activity of the component vascular tissue rendering that mode of removal in the highest degree perilous. To cut into the texture of such a tumor, when large and pulsating, would be madness; the gush of blood might prove almost instantly fatal. To cut even wide of the diseased texture, is not always a matter of safety. Unless the knife move cautiously, and forceps and ligature follow nimbly after, the loss of blood will still be dangerous. The mode of removal by excision, therefore, must be limited to those tumors which are small—not larger than a prune—of no unusual activity, not fed by large and numerous arterial trunks, so situated as to admit of the incisions being made wide of the diseased structure, and also in a locality favorable for use of the ordinary means of restraining hemorrhage. In all other cases, ligature is preferable.

A needle (Fig. 209 *b*) is passed beneath the mass, carrying a stout ligature; the [illegible] withdrawn, and the ligature left. The noose having beer [illegible] on is tied separately on either aspect, so as to include t [illegible] ıorbid tissue; pulling with as tight a strain as the ligat [illegible] der at once to kill the included part, and save both [illegible] 41). If the swelling be circumscribed and promi [illegible] igation will be found very suitable. If diffuse, a s [illegible] ure may be passed at right angles to the first, and managed in a similar way; the tumor then being secured by four nooses instead of two. Or, if too flat and spread for even this, two harelip pins may be passed beneath the base, at right angles to each other, and left there; each extremity of each needle protruding somewhat beyond the integument. Then a stout ligature is thrown around the whole mass, and drawn tightly; secured beneath the protruding ends of the needles. In this way, the noose is made to embrace the whole of the diseased formation. Whichever method is adopted, it is often necessary, in the case of large tumors, to make a fresh application within a few days after the first, in order to expedite sphacelation.

More complicated means of deligation may be practised.[1] But in ordinary circumstances the simple methods now described will be found quite sufficient.

In all cases in which the integument is uninvolved, the use of knife and ligature may be happily combined; the former being employed, in the first place, to reflect the integument in flaps, and thus to expose the diseased structure naked and defenceless to the needle and ligature. In this way, strangulation is effected much more effectually; the part is killed at once, and soon sloughs away. The flaps are then reponed; and, in consequence, not only is the process of cure by granulation abbreviated, but loss of substance also is saved, and the result is less cicatrix and deformity:—a point of some considerable importance, when it is remembered that the most ordinary sites of the tumor are on the head, face, and neck.

Fig. 199.



Erectile tumor, in a common situation. The integument, uninvolved, has been reflected by flaps. Transfixion is being completed, previous to deligation. *a*, The larger ligature, in the act of being pulled through. It fills the aperture of puncture, preventing bleeding; and besides, bears a stronger strain in the tying.

Sometimes the morbid structure is so diffuse, as to render inclusion of the whole, by one deligation, impracticable. In that case, it may be taken away in detachments; the operation being repeated at different parts, successively.

2. *By diminution of the arterial supply.*—When the tumor is so situated as to be remedially inaccessible, either by knife or ligature,

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[1] Fergusson. Practical Surgery, last edition, p. 163.

ulceration is likely to occur; and hemorrhage follows or
easily restrained; demanding active interference, oth ga-
or continuance it may exhaust the patient. Or ulc of the
salutary result. If surrounded and preceded by ted; and
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ity of failure is at all considerable, it is better to have recourse at
once to that remedy which is certainly infallible. The more especially
as one mode of operation is usually formidable in the eyes of the patient
and friends as another.

4. *By amputation.*—If the diseased texture involve the greater part of a finger or toe, foot or hand, as sometimes happens, it is well at once to amputate the affected part; due arrangements having been made for the unusual amount of hemorrhage which is likely to occur.

The second form of vascular tumor, consisting chiefly of enlarged and tortuous veins, is in general most conveniently treated by deligation. When small, and on an external part, however, it may be excised.

The first form of growth, or nævus, may be excised safely enough; if the deformity be deemed by the patient a sufficient warrant for so severe a measure. In the majority of cases, it will be h tent ourselves with inducing ulceration. The potass, n ation, will here be found very efficient.

this mode of treatment is advisable. When, for example, erectile tumor occupies the cavity of the orbit, we are warranted in performing deligation of the common carotid; and experience has spoken in favor of the practice. Circulation is weakened in the tumor, not arrested; and coagulation may partially occur, causing obliteration; but it is more probable, that the dilated vessels merely recover their normal calibre, and remain pervious. Immediately after the main artery's deligation, they are comparatively empty, and remain so until the collateral circulation is fully established; and, their tone never having been lost, they naturally contract, and accommodate themselves to their reduced contents. By the time circulation is fully restored, they may have become confirmed in their diminished bulk; heart's impulse being still modified, redistension will not occ s salutary result is greatly favored by free bloodletting, after the operation; a practice in two points of view highly expedient: first, because protective of internal organs from congestion, as formerly explained (p. 503); second, by maintaining a diminished circulation in the part, as well as in the whole system, favorable to the desired salutary change. At the same time, the other means, formerly spoken of as conducive to languor of circulation, will not be neglected (p. 517).

When the arteries which feed the tumor are numerous, deligation of the principal trunk at some distance is not likely to prove effectual. In such circumstances, it has been proposed to surround the tumor by incision, so as to cut off the vascular supply; tying each vessel as it springs; inducing flaccidity and collapse of the tumor; and by continued pressure, afterwards, probably causing obliteration of the morbid tissue. Or, instead of deligation, the feeding arteries may be obliterated by the twisted suture; as in varix. The practice has been adopted with partial success; but in all situations where deligation of the tumor is available, this is much to be preferred.

3. *By effecting change of structure;* consolidating the contents of the vessels, and obliterating their canals; converting by fibrinous exudation the loose tubular texture into a dense and compact mass. This may be effected in various ways.

Pressure may be applied with sufficient intensity. Sloughing may occur; but if this be preceded and accompanied by dense plastic exudation, no harm will result.

If the growth be small and superficial, a fine needle may be passed beneath, and a roll of ligature applied above, as in twisted suture; the needle being withdrawn, so soon as the inflammatory process seems to be sufficiently excited by compression. Formations capable of being so treated are not unfrequently found on the bridge of the nose; especially in the female. And I have succeeded, by this method, in obliterating an erectile tumor of considerable size and activity, situated on the finger.

Potassa fusa may be applied. Not intensely, so as to produce a large eschar; for, on its separation, there would be a likelihood of hemorrhage: but slightly, so as to induce ulceration—imitating the form of spontaneous cure which sometimes occurs thereby.

A hot needle, or one dipped in any caustic, may be introduced, and moved in various directions through the mass. The inflammatory process follows; accompanied by more or less of the desired plastic deposit. The hot needle introduced frequently and freely, so as to traverse all parts of the tumor, is admirably suited to the minor cases so common in young children. The result is most successful; and anæsthesia averts all suffering.

Or, with a like view, some stimulating fluid may be injected through a puncture; by means of a fine syringe, such as Anel's. This proceeding, however, is not devoid of danger; by the induction of diffuse infiltration, sloughing of the areolar tissue, and grave constitutional disorder. Patients of tender years have perished in consequence.

A seton may be passed through the tumor; the needle small; and the thread large, so as to occlude the aperture completely, and prevent immediate bleeding. It is worn till suppuration is fully established, with plastic exudation more or less copious, around its track; and if need be, one or two such may be made to traverse the tumor in various directions.

The part may be inoculated with croton oil; expecting obliterative inflammation to follow. Or into a puncture nitric acid may be dropped; hoping for obliteration, partly by exudation, and partly by sloughing.

Vaccination may be performed on the part. A child having been born with such a growth, vaccine virus, at the ordinary time, may be inserted beneath the skin at various points of the little tumor, instead of at the usual site. The likelihood is that the inflammatory process, which attends formation of the vesicle (p. 100), will have an obliterative effect on the morbid tissue. Repeatedly I have seen this mode of treatment prove not merely sufficient but excessive in its action; the morbid structure sloughing, and not alone; causing considerable loss of substance, and grave constitutional disturbance.

All such minor modes of treatment, however, as have been considered under the third head, are liable to fail; rendering subsequent recourse to more stringent measures necessary. And it is prudent, therefore, to limit their use to the minor examples of the disease. Wherever probability of failure is at all considerable, it is better to have recourse at once to that remedy which is certainly infallible. The more especially as one mode of operation is usually formidable in the eyes of the patient and friends as another.

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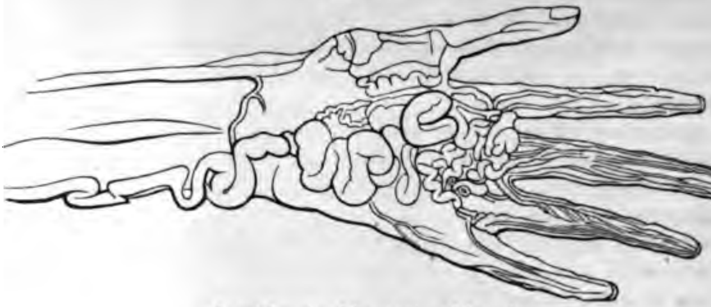
Not unfrequently, what seems to be but a nævus in the infant, grows into an erectile tumor during childhood or adolescence.

Another form of nævus consists merely of discoloration; dependent on a perverted condition of the pigment. Vesication may be tried; by the nitrate of silver, or otherwise. But, in truth, the affection is so trivial as scarcely to call for interference.

Arterial Varix.

By this term is meant a dilated and tortuous condition of an artery, analogous to what is so common in veins. It chiefly occurs in superficial vessels of a minor class; as the branches of the temporal and the arteries of the forearm and hand. But it is a comparatively rare affection. Relief may be obtained from gentle and uniform support, by bandaging. When limited and troublesome, it may be removed by transfixion and ligature; as in varicose veins. Lately, I thus destroyed an arterial varix, of some size and great activity, in the web between the thumb and forefinger of an artist; who attributed the origin of the swelling to pressure made by habitual wearing of the palette. Previously to deligation, I had made trial of acupuncture and galvanism, with a view to obtain consolidation of the arterial contents; but in vain.

Fig. 200.



Arterial varix of the arteries of the palm.

Lancisi, De Aneurismatibus, Rom. 1728; Guattani, De Externis Aneurismatibus, Rom. 1772; Scarpa Sull'Aneurisma, Pav. 1804; Hodgson, on Diseases of the Arteries and Veins, Lond. 1815; Cruveilhier, Anatomie Pathologique, Paris, 1816; Harrison, on the Arteries, Dublin, 1824; Wardrop, on Aneurism, Lond. 1828; Turner, in Edinburgh Medico-Chirurgical Transactions, vol. iii, p. 11, 1828; Guthrie, on Diseases and Injuries of Arteries, Lond. 1830; Dupuytren, Mem. sur. les Aneurysms, Repert. Gen. d'Anat. et de Phys. vol. v, Paris, 1830; Hope, on Diseases of the Heart, Lond, 1832; Manec, de la Ligature des Artères, Paris, 1832; Breschet, Mem. Chir. sur. diff. espèces d'Aneurysmes, Paris, 1834; Porter, on Aneurism, Dublin, 1841; Gulliver, in Med.-Chirurg. Transactions for 1843; Peacock, on Dissecting Aneurism, Ed. Med. and Surg. Journal, 1843, and Monthly Journal, 1843, and 1849; Henderson, Monthly Journal, July, 1843; Erichsen, Observations on Aneurism, Lond. 1844; Bellingham, on the Treatment of Aneurism by Pressure, Dublin, 1845; Dublin Quarterly Journal of Med. Science, August, 1846, p. 104; Crisp, on the Structure, Injuries, and Diseases of the Bloodvessels, London, 1847; Hasse's Pathological Anatomy, translated by the Sydenham Society; Rokitansky's Pathological Anatomy, vol. ii, published by the Sydenham Society. *On Aneurisms of particular Arteries, see references in Otto's Pathological Anatomy,* 1831.

CHAPTER XV.

AFFECTIONS OF VEINS.

PHLEBITIS.

By this term is understood the inflammatory process, in its various grades, occurring in venous tissue; an affection infinitely more common than arteritis. Chronic degeneration of the coats, on the other hand, so frequent in arteries, is in the veins comparatively rare.

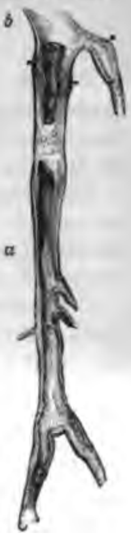
Phlebitis may be idiopathic or traumatic; the result of injury, or unconnected with any assignable external cause. The same circumstances which favor the accession of erysipelas, seem also to predispose to this disease.

Coats and contents are altered by the morbid process. In the minor grades, the latter assume the solid form, and become incorporated with the coats; which are thickened and rendered opaque, by fibrinous deposit. Pus may be deposited between the thickened coats; constituting abscess there. Or it may be formed in the interior of the vessel, as more frequently happens; either accumulating in the form of abscess, the canal being obstructed by consolidation above and below; or mingling at once with the passing blood, the vein remaining pervious. A more chronic form of the higher grade, limited to one part of the vessel, causes ulceration and hemorrhage; a result not so common as in arterial tissue, and more frequently making its approach from without than from within. Suppuration, on the other hand, rare in arteries, is too common in veins.

The tendency of the inflammatory process, when developed in the venous tissue, to extend rapidly and far by continuity, is not easily explained. At one time it was supposed that, in consequence of this, the fatal issue of the more aggravated cases could be accounted for; inflammation having reached the right side of the heart, and arrested its all-important function. But experience has shown that such is not the case. In the great majority of examples, inflammation has stopped before the heart has been reached; usually terminating abruptly, where a cross current flows in upon the main, through a collateral branch. How the cross branch should produce this arrest, it is difficult to say; but that it has this effect is undoubted. The extent of femoral phlebitis, for example, is likely to be abruptly limited where the saphena joins; humeral phlebitis terminates where the cephalic enters.

The obscurity which at present rests upon the nature of phlebitis forbids us, in the meantime, from making the attempt to discuss its causes and general pathological relations. In the great majority of cases, it is undoubtedly connected with an external suppurating wound, such as exists in amputation or after injury. In not a few instances, it is also found in connection with pyæmia; and this fact has led to the idea, that the pus developed within the vein may have been, in part, absorbed from the exterior, rather than secreted by the tissues of the vein itself. However this may be, it is certain that the walls of the vein, and even the adjoining tissues, participate in the morbid process; as is shown by their thickened condition, and not unfrequently by the occurrence of suppuration there. We must, therefore, treat of phlebitis as a distinct affection, often combined with, and perhaps causing pyæmia, but not necessarily connected with it; inasmuch as the affection in the vein frequently stops short of the formation of pus; and pus, when formed, is often limited by fibrinous effusion, which prevents it from reaching the general circulation.

Fig. 201.



Fibrinous Phlebitis. *a*, The femoral vein, occluded by solidified contents. At *b*, the saphena enters; and consolidation ends abruptly there.

I. Fibrinous Phlebitis.—This is the minor grade of the process; giving no worse result than fibrinous exudation. There is pain in the affected part, increased by pressure; and the vein is felt thickened and hard. The integuments are involved; presenting a broad, red streak, immediately above the affected vein, and corresponding in extent. Sometimes erysipelas is coexistent; and then the peculiar stripe becomes merged in the general redness. The system labors under a febrile accession; slight, and of the inflammatory type. The venous contents coagulate. The coats become thickened by fibrinous exudation. Plasma is also found in large quantities in the interior of the vein, and contributes towards incorporation of the fibrin of the blood with the venous tissue, consolidating the whole into one impervious mass. The vessel then feels a firm, hard, and painful cord. The limb—the lower limbs are the ordinary site of this form of the disease—beneath the affected part, is more or less swollen by passive congestion; the result of venous obstruction. And the areolar tissue around the inflaming vein is also somewhat œdematous. On the inflammatory process subsiding, the cord begins to decrease; deposit abates, and absorption begins. Then one of two events may occur. Either absorption may remove the coagulum, as yet but imperfectly incorporated with the plasma, and the vessel's tube becomes pervious as before; a thickening of the coats being the only remnant of the morbid results. And this is much more likely to occur than in an obstructed artery; for experience proves that a vein, hard and obviously impervious for weeks, may again open up its cavity, and carry blood as before;—an event rather too common after the treatment of varix with a view to the radical cure. Or, obstruction continues; the coats and solid contents remain completely incorporated; both dwindle down by uniform absorption; the vessel's tube is obliterated; and itself degenerates into the semblance of a mere thread

Ordinary antiphlogistics, moderately applied, suffice for the treatment of this form of the disease. Rest, fomentation, low diet, purging, aconite, or antimony. Leeches are not often demanded. When deemed necessary, they are applied near the affected part; but not on the stripe of red integument, otherwise erysipelas might ensue. If it be an object to procure an open state of the vein—as, for example, when painful œdema of the lower limb must otherwise remain, mercurial applications may be used over the affected part, after subsidence of the acute stage.

II. Suppurative Phlebitis.—This is often of traumatic origin. It may occur in one of two forms: Limited or Diffuse; the former comparatively safe, so long as the character of limitation is retained; the latter invariably fraught with the utmost danger. 1. *Limited.*—The morbid process commencing of a minor grade, the same results ensue as in fibrinous phlebitis. Coats are thickened; contents are solidified; circulation is arrested at that point. Then suppuration takes place; and the pus mingles with the coagulum, which becomes broken up. The venous coats yield to the accumulating fluid; and, bulging outwards, produce a fluctuating tumor; the integuments become more red, and swollen; in short, the ordinary characters of acute abscess are presented. Above and below the suppurated part of the vein, the incorporation of coats with contents is not disturbed. Dykes, composed of plasma intermingled with coagulum, remain; presenting a salutary barrier to the irruption of pus into the open portion of the vessel, and thence into the general circulation. The constitutional symptoms are of the sthenic inflammatory type; more marked than in the simple fibrinous form.

2. *Diffuse.*—Here there are no protective dykes; all has given way before acute suppuration. There is no bulging tumor; no indication of matter accumulating, and approaching the surface. The circulation was only temporarily arrested; during the brief fibrinous change. It is again fully restored; and pus, mingled directly and in large quantity, with the blood, is carried at once into the general circulation; producing the most direful consequences, as if a poison (p. 204). Constitutional symptoms, preceded by rigors, set in of the most urgent kind; first irritative, then typhoid, and tending to rapid and fatal prostration. Not unfrequently, superficial abscesses form over the affected vein; sometimes the areolar tissue there is the seat of diffuse infiltration.

The disease may have been from the first of this kind; then the symptoms too, from the very commencement, are urgent. Or the limited form may have degenerated into the diffuse; the protective dykes having stood for a time, but at length giving way before disruptive inflammation. In the latter circumstances, the occurrence of change from limited to diffuse is marked; locally, by dispersion of the soft swelling; constitutionally, by intense shiverings, followed immediately by formidable constitutional aggravation.

In whichever way the diffuse form supervene, in the greater number of cases it proves fatal; not by extension to the heart, as has been already stated; but by the typhoid symptoms consequent to, and doubtless dependent on, direct and copious admixture of pus with the circulating blood. The fatal issue is usually accelerated by the formation of *purulent depôts*—their most frequent site being in the lungs (p. 205). They seem to be formed with great rapidity; within a few hours. Yet they are no exception to the general rule, of inflammation being preliminary to suppuration. The inflammation is present, and precedes; differing from its ordinary character only in the greater rapidity with which its suppurative crisis is attained. Neither are they the result of mere conveyancing, as some have supposed. The pus of the suppurated vein is not carried to the heart, from thence to the lungs, and when there simply deposited in the parenchyma. The pus is a secretion from the inflamed part; the only difference from an ordinary suppuration being, the rapidity with which the formation of abscess is completed.

The precise nature of the circumstances which lead to this result is still a matter of uncertainty and dispute; but the following may be considered at least an approximation to the truth. The pus, directly and profusely mixed with the blood, acts as a poison on the frame, and accordingly the circulating system—as it were, by a self-protective effort—endeavors to free itself from this noxious matter by elimination. The natural organ for such elimination is the lungs; and thither the pus is sent. But as this elimination, for causes not yet fully understood, cannot take place by a simple act of secretion, there is necessarily established an acute inflammatory process; which, occurring in a part and system of low vital power—for by this time typhoid symptoms have been fully established—attains rapidly to its suppurative crisis. Purulent formation in the liver may be similarly explained; this organ perhaps being most likely to suffer, in the case of phlebitis situate in the abdominal organs; the lungs, in phlebitis of the limbs. Explanation of the involvement of joints is not so easily afforded; unless we, even somewhat more imaginatively, suppose that the eliminating effort, foiled in more ordinarily selected parts, seeks the aid of a common secreting surface.[1]

In the treatment, our chief object is to prevent suppuration if possible. Antiphlogistics are applied actively and early. In the robust, a full bleeding may be taken from the arm; in most cases local depletion may be freely employed. Leeches are used plentifully; in two divisions, one attacking the main seat of disorder; the other operating on a part of the vein as yet either entirely free, or involved only in a minor grade of the process, and situated on the cardiac aspect of the part chiefly affected. Our object is not only to subdue the inflammation already risen; but also to prevent that acute extension to which phlebitis is so prone. At the same time, we seek to insure, so far as we can, that when the affection does reach the higher point of the vein, it may be of a subdued form, favorable to consolidation; and that so a dyke may be constructed, whereby pus, when it does form in the part originally seized, may be prevented from admixture with the circulation. Absolute repose is maintained; of the whole body, and more especially of the part. Hot fomentation is diligently used; medicated by a weak solution of acetate of lead with opium. Should we succeed thus, in either preventing suppuration altogether, or in confining it to the limited form, the event is fortunate; the constitutional disturbance is slight, life is not perilled, and the local change can be easily recovered from. Should we fail, however, as is not unlikely; should suppuration not only have occurred, but be plainly of the diffuse form—then blind adherence to antiphlogistic treatment is but infatuation. Typhoid symptoms are already setting in; the system already has begun to yield. The whole plan of treatment must be at once changed; prostrating remedies being desisted from, and stimulants held in readiness for free yet cautious and skilful use. Our duty then is to support the system, by prudent stimulation; affording a chance—by affording time—for safe elimination of the noxious admixture, and consequent rallying of the system from its poisonous effects.

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[1] "If the entire pus corpuscles have been taken up by the venous system, they either reach through the heart and pulmonary artery into the capillary structure of the lungs, or, in case the purulent deposition was seated in organs whose veins formed the *vena portæ*, they reach through these into the capillaries of the liver. Now, as the pus corpuscles are in general too large to pass through the fine capillary network in the lungs and liver, it is evident that, for this reason, they must begin to stop here, to accumulate, and to occasion a stasis as foreign irritants. These, then, form new pus depositions, which progressively become greater from the constituents of the blood, and of the parts of the tissue capable of it. From this simple cause, it is easily explained why secondary abscesses form so readily in the liver and lungs. If the pus deposited in the liver, and newly formed, be taken up by the hepatic veins, these bring it into the heart and into the lungs. If it be taken up from these by the pulmonary veins, it may be deposited in every other organ to which the blood comes from the left ventricle. In this case secondary abscesses may form in the brain, in the kidneys, in the spleen, &c., and pus may even be discovered in the urine."—*Translation of Zimmerman, Med.-Chir. Review*, July, 1844, p. 152. The chief objection to this mechanical view is, that pus corpuscles are not, in general, too large to pass through the capillaries.

Be it understoood, however, that the above system of treatment is not applicable to all cases of the disease; only to those which are under charge from the commencement; and in which the preliminary symptoms are more or less of the sthenic type. There are many cases seen for the first time, when that stage is past. In these, antiphlogistics are never to be thought of. There are not a few, in which from the very commencement the symptoms are altogether asthenic; evincing rather the irritative than the inflammatory type; and in these the most active antiphlogistics, especially loss of blood, even at the very outset, must be used sparingly, if at all. Should erysipelas coexist, it is to be regarded as a minor evil, and treated accordingly. It is, however, an unfortunate and serious complication; and unfavorably qualifies the prognosis.

Blisters applied in narrow strips over the inflamed vein, are highly extolled by some and reprobated by others. In this country, the preponderating opinion seems not in their favor. They are not unlikely to fail in arresting phlebitis, while they may succeed in inducing erysipelas. If used at all, it must be with much circumspection, and subsequently to local depletion. In fibrinous phlebitis they are more suitable; should chronic inflammatory disease prove obstinate. They may have a favorable effect in removing such affection; at the same time promoting absorption of the coagulum and deposit—should that be an object of desire.

In limited suppuration of a vein, the same treatment is to be followed as in ordinary acute abscess. A free and early incision is made; followed by fomentation, poultice, and rest. No unwonted hemorrhage occurs; the venous canal being obstructed at each extremity of the abscess. The cavity granulates and closes in the ordinary way. Should incision be delayed, there is danger of the protective dykes yielding before the pressure of accumulating pus, and of the case being thus unfortunately converted from the limited form into the diffuse; from a comparatively trifling affection, into one which most frequently terminates in death.

Seeing the importance of fibrinous dykes, it has been proposed artificially to induce their formation, in urgent cases of phlebitis; by applying potass, or other caustic, to a portion of vein on the cardiac aspect of the affected part. The attempt has failed, however, as might have been expected; the phlebitis induced proving not obliterative, but suppurative; the original disease not becoming limited, but extending and still diffuse.

Such being the dangers of phlebitis, it surely follows that the exciting causes of that disease should be most carefully avoided; in other words, that we shun interference with the venous tissue in operations as much as possible; and that more especially deligation should be withheld. A certain amount of true inflammation must follow, to throw off the noose; and it is not unlikely to spread, at once establishing the worse form of the disease (p. 324). Surgical opinion, no doubt, is divided upon this subject. One class of practitioners have no dread of tying veins, and do not hesitate to do so, when venous hemorrhage is at all troublesome. Another, possessed of a salutary fear of phlebitis, withhold the ligature, unless under circumstances of the most extreme urgency; and at all times are chary of disturbing the larger veins, by knife, finger, or forceps. In the latter class I would beg to be included. Surely, if we err at all, it is well to do so on the side of safety.

It should also be borne in mind, that the air of hospitals predisposes strongly to the occurrence of phlebitis; and that therefore, in public practice, we should be especially careful of interference with the venous tissue. Another duty is very plain; that we abstain from overcrowding of wards, and take every other means in our power to avoid induction of noxious atmospheric influence.

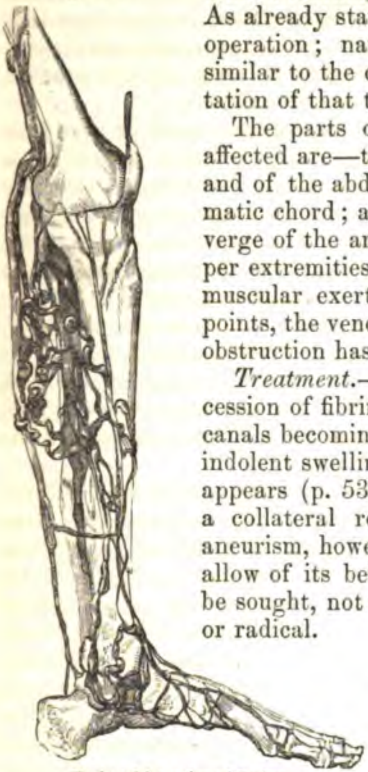
VARIX.

By this term is understood an enlarged, elongated, and tortuous condition of the veins of a part; usually superficial. Dilatation is not uniform but bulging; and is usually greatest at the site of the valves. These, no longer proportioned to the enlarged calibre, have become inoperative; they exert no influence on the circulation; and ultimately shrink and almost disappear; in obedience to the general law that what is useless is taken away. The coats are not attenuated; but, on the contrary, are thick and rigid. Not improbably they have undergone a chronic form of phlebitis, of a very minor grade; analogous to that chronic arteritis which induces degeneration of the arterial tissue favorable to aneurism (p. 481). And this supposition is strengthened by the circumstance, that the disease seldom occurs till after adult age. When so affected, the altered tissue becomes peculiarly prone to acute inflammation.

The limb beneath is liable to œdema; and its vital power, as well as its ordinary function, are more or less impaired. It is prone to assume the inflammatory process on its surface; and this tends to ulceration (p. 231). The ulcer, spreading, may perforate the vein; and troublesome hemorrhage ensues. Pain and a sensation of weight usually attend, independently of ulceration; and sometimes neuralgic pains occur in the part affected.

The direct cause of varix is whatever obstructs venous return; for example, pressure on the venous trunk above, as by distended rectum, enlarged uterus, or any other tumor. As already stated, a predisposing cause is probably in operation; namely, venous degeneration, somewhat similar to the chronic arterial change favorable to dilatation of that tissue.

Fig. 202.



Varix of the veins of the leg.

The parts of the venous system most frequently affected are—the superficial veins of the lower limbs, and of the abdominal parietes; the veins of the spermatic chord; and the lower hemorrhoidal veins, at the verge of the anus. Sometimes varix occurs in the upper extremities, in consequence of sudden and violent muscular exertion. It may be that, at one or more points, the venous coats have partially given way; and obstruction has followed at the yielded part.

Treatment.—A spontaneous cure may result, by accession of fibrinous phlebitis in the affected veins; their canals becoming consolidated, and constituting a hard indolent swelling, which, by absorption, ultimately disappears (p. 530). The blood finds another outlet, by a collateral route. Like the spontaneous cure of aneurism, however, this is not sufficiently frequent to allow of its being trusted to in practice. Cure must be sought, not merely hoped for. It may be palliative or radical.

1. *Palliative.*—Bearing in mind what was formerly stated regarding the propriety of not unnecessarily interfering with the venous tissue by operation, and also remembering that varix is in most cases rather a deformity and inconvenience than a disease of itself dangerous to life, it will be readily understood how this mode of treatment should be regarded as the more generally applicable. It consists in the removal of the cause, and in affording support to the dilated veins. The rectum is emptied, and kept habitually clear, by suitable laxatives; and if other compressing agents are in force, they too must be removed, so far as may lie in our power. In the case of pregnancy, we must patiently wait for the natural relief by parturition. If hepatic derangement be indicated, the suitable remedies must be employed.

The erect posture should not be long maintained at any one time. And uniform support of the affected part is to be afforded, by bandaging or a laced stocking—or by what is better than either, in most cases, an elastic stocking; well fitted, and tight enough to diminish the venous calibre and volume of blood; not only preventing increase of the disorder, but giving an opportunity for contraction and partial recovery, should sufficient tone remain; yet slack enough to admit of motion, and obviating undue constriction of the limb.

If the patient do not grudge the leisure and confinement, more active measures may be adopted. Maintaining the recumbent posture, pressure may be applied with more intensity, and without chance of interruption; as by the starched bandage, or by encasing the limb in a mould of gypsum. After the perseverance of a week or two, the dressings may be undone; with the hope of finding not a mere temporary alleviation, but perhaps a permanent and effectual cure; partly by obliteration, partly by restoration of the normal calibre and tone.

It is no uncommon thing for life to be brought into peril, or even lost, through a simple varix. Suppose, as often happens, that a patient in the lower ranks, much in the erect posture, and following a laborious avocation, has a varix of the leg, with ulcer of the superimposed integument. Suddenly, the vein may give way, by ulceration; or a knife, hatchet, or other tool, makes an accidental wound. Profuse hemorrhage occurs; much blood may be lost in a few minutes; the patient faints; ineffectual means are taken by the bystanders to arrest the bleeding; he recovers; the hemorrhage returns; and, by its repetition, he may be fatally exhausted ere surgical aid arrive. Many lives might be saved, were it more generally known that, in all cases of venous hemorrhage, gentle but accurate and steady pressure of the finger or thumb, on the bleeding point, will effectually restrain the flow.

2. *The Radical Cure.*—This depends on effecting obliteration of the affected veins. They may be directly incised, and compressed. Suppuration of the wound necessarily follows; and if it heal kindly by granulation, obliteration of the venous cavities will doubtless be obtained. Or a portion of the vein may be excised; and pressure may be applied to each cut extremity, so as to restrain bleeding, and favor fibrinous occlusion. Or the vein may be cut down upon, and encircled by a tightly drawn ligature; as if it were an artery. All these three modes are doubtless perfectly equal to the obtaining of the desired obliterative result; but ample experience has shown, that the inflammatory process seldom ceases short of suppurative phlebitis; and that this not unfrequently assumes its worst and most dangerous aspect. Many patients, endeavoring to free themselves from the inconvenience of a mere varix, by such means, have lost their lives, by the induction of diffuse suppurative phlebitis. Deligation is obviously inapplicable; a certain amount of suppurative inflammation of the vein must inevitably follow, and is very apt to spread (p. 324).

If incision be attempted at all, it ought not to be direct, but by the oblique and subcutaneous method of puncture; so as, if possible, to avoid inflammation and suppuration in every part of the track of the wound. Pressure is required afterwards, to restrain the escape of blood and prevent infiltration of texture. Let not this be severe; a very moderate degree, if applied and maintained with accuracy, is sufficient to arrest venous flow; and severity, coming after wound, is certain to induce what we wish to avoid—true inflammation. This method was at one time practised by Brodie, but with indifferent success. Now that the principles of subcutaneous section are better understood, the execution might be more skilful, and the issue more prosperous. But still two difficulties must remain: first, the risk of inflammation, and danger to life thereby; second, the chance of speedy healing of the wound, the vein at once uniting and resuming its unbroken flow, just as before the operation.

Modern experience and opinion are decidedly in favor of two other modes of treatment: cauterization, and application of the twisted suture. The most convenient mode of applying *caustic*, is in the form of what is termed *Vienna paste;* equal parts of quick lime and potassa fusa. An incision is made through the skin, over that part of the vein which we wish to obliterate; and a few minutes are permitted to pass unoccupied, that capillary oozing of blood may cease. Then, the surrounding textures having been protected by a piece of lint, with an aperture in its centre—the aperture corresponding to the exposed part of the vein—a portion of paste is applied in contact with the venous tissue, and there retained; either permanently, or only for a time, according to the size of the portion applied, and the extent to which we wish to make the eschar. The object is to produce a complete slough of the venous coats; to be followed by a surrounding areola of sthenic inflammatory process, giving fibrinous exudation; whereby the venous canal may be obstructed permanently, for some distance above and below the cauterized point. And then the suppuration and ulceration, necessary for detachment of the slough, are not likely to extend beyond the mere vicinity of the dead part.

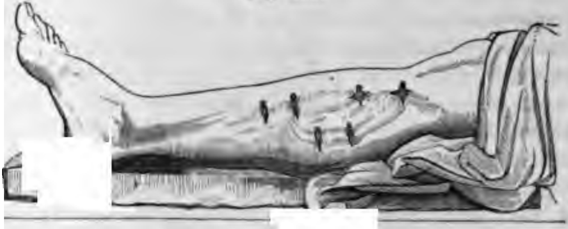
This cauterization may be employed in two ways. It may be applied to a sound part of the great venous trunk, above the varicose branches; to the saphena in the thigh, for example, in the case of varix of the leg; pressure being at the same time used to the dilated veins. The effect of obstruction above is expected to be, that the blood will seek another channel; collateral, or in a deeper plane; and that consequently the affected veins, much disburthened, and now comparatively idle conduits, may have an opportunity either of recovering their calibre and tone, or of being obliterated by consolidation. Or the caustic may be applied to the dilated veins themselves, at various points, so as to insure obliteration.

For some days before the caustic's use, the patient should maintain recumbency, and otherwise undergo the same preparatory treatment as for operation on account of aneurism. During the whole progress of cure, recumbency, antiphlogistic regimen, with absence of all excitement, must be observed; and, at the time of the slough's separation, precaution should be doubly vigilant. At this period, were the patient to get out of bed and walk about, or indulge imprudently in diet, hemorrhage—great, and perhaps fatal—might possibly ensue. And further, that being the period of inflammation and ulceration of the venous coats, for detachment of the slough, such imprudence might very probably lead to extension of the phlebitis; a greater danger than even that by loss of blood.

It is also to be remembered that, independently of all immediate risk, the caustic sores may prove indolent and slow to heal; perhaps becoming a source of greater inconvenience than the original malady, on account of which they have been incurred.

The twisted suture is applied directly to the affected vein, in the following manner; and is generally preferred, as the simpler and safer

Fig. 203.



Obliteration of varicose veins, at three points. The radical cure.

mode of treatment. A needle, such as used for harelip, is passed beneath the vein; and round it a silk or thread ligature is twisted, so as to completely obstruct the venous canal at that point, and compress the coats with some power against the needle. This application is permitted to remain undisturbed for some days. Should much pain, swelling, and redness occur, then the needle is withdrawn; the vascular excitement is sufficient for occlusion; and it would be imprudent to seek a higher grade by continuance of the exciting cause. If, however, no uneasiness be complained of, beyond what is ordinary and desirable, the needle may be permitted to remain undisturbed, until it becomes spontaneously detached by ulceration. For, in those cases in which the application has been but temporary, experience has shown that renewed circulation is liable to occur, at the part supposed to have been obliterated. And, accordingly, it is well to apply the ligature very gently at first, so as to avoid all risk of being compelled to remove the application. It is better that the threads should be so slack as to render the progress even tedious, than that tightness should either induce dangerous inflammation, or render it expedient to risk an abortive result by premature removal.

Points of suture are applied, in this way, at various parts of the dilated vein, or veins; so arranged, as to site and number, as most favorably to conduce towards the obliterative result. The same preparatory and attendant treatment is necessary, as for the remedy by cauterization. And let it ever be remembered, that there is not only greater risk from, but greater probability of, too much than too little of the inflammatory accession. As already stated, a varicose vein is more prone to acute inflammation, than a vessel previously in all respects healthy.

Should erysipelas attack the part, the needles are at once withdrawn. And the anti-erysipelatous treatment behooves to be especially alert; seeing that by its invasion suppurative phlebitis has been rendered very imminent. My own experience would dissuade from the use of nitrate of silver, except in the very mildest cases (p. 339). I think I have seen it determine phlebitis, by a kind of metastatic action.

In whatever way radical cure is attempted, the erect posture and laborious avocations ought to be very gradually resumed; and uniform support, by an elastic bandage or stocking, should be afforded to the affected parts for a long time after. Otherwise, a return of varix, even in the same vessels, is more than probable. For the venous tissue in no respect more widely differs from the arterial than in this—a proneness to resume the open state, after apparently complete occlusion. And though the shut vessels remain unaltered, their collateral neighbors, now busy in the dropped function of the others, are very apt to assume the varicose change.

And again, let it be well understood that the risk, by phlebitis, attendant on the simplest and best of these methods of radical cure, is not slight; that, therefore, both patient and surgeon should rest contented with the palliative mode of treatment, unless in those cases in which the inconvenience is great, and obstinate and serious ulceration attends, perhaps with hemorrhage; and that, under no circumstances, ought the surgeon to undertake the operation, far less to urge it, unless the patient be made fully aware of the amount and kind of risk which is necessarily encountered.

Phlebolites.

By this term is understood earthly concretions which form in the coagula of obstructed veins; sometimes merged in the substance of subsequent solid enlargement, more frequently constituting small hard swellings of their own. The only remedy is by excision.

ENTRANCE OF AIR INTO VEINS.

This is a casualty of a most alarming nature; and may occur during operations which implicate section of the larger veins. In wounds of the lower part of the neck and of the axilla, a venous orifice is apt to become gaping, or "canalized," during deep inspiration; and then atmospheric air will enter in greater or less quantity.

Certain circumstances favor the accident's occurrence. 1. The site of the wound. The lower part of the neck, and upper part of the thorax, are the most dangerous localities. 2. The condition of the venous coats. If thickened and rigid, by chronic deposit, they tend to remain open when cut; like an arterial tube rather than a venous; a condition most favorable to the air's entrance. 3. The state of the surrounding parts. These may be dense and consolidated, so as not to permit contraction of the venous orifice; maintaining it widely open, as in section of the hepatic veins. Or spasmodic contractions of the muscles may have a similar canalizing effect. 4. The degree of traction made upon the vein. The vessel, if loose when cut, is not so apt to gape, as when tightened by pulling; as it often may be, at the time of section, in the extirpation of tumors. 5. The form of wound in the vessel. The vein, if completely severed, is likely to collapse. If cut only partially, and in a transverse direction, while by traction it is made tense, the aperture cannot choose but gape. 6. Position of the part operated on. If relaxed, collapse of the venous orifice is favored; if, on the contrary, placed on the stretch, as usually is the case to a greater or less extent, to facilitate dissection, canalization is rendered more likely. 7. The position of the vein in the wound. A large vein punctured, and situated in the angle between two flaps of a wound, is probably made to gape at each opening up of the incision.

Canalization of the vein, combined with deep inspiration, is all that is required; and it is consequently matter of surprise, that the untoward event should not be of more frequent occurrence. The symptoms which denote it are as follows:—A noise of air, in motion through a narrow space, is heard; sometimes hissing; more frequently of a lapping or gurgling sound. This is immediately followed by a convulsive struggle; often preceded by a sudden exclamation of impending danger or death. A "churning noise is heard in the heart, synchronous with the ventricular systole;" and the hand applied to the chest "perceives at the same time, a peculiar bubbling, thrilling, rasping sensation, occasioned by the air and blood being, as it were, whipped together" within the ventricle.[1] If but a few particles of air have entered, the alarming symptoms pass away, and the patient rallies. If, however, the entrance have been copious, convulsions continue; syncope occurs, and is permanent. In some cases, death has proved quiet and rapid, as if by simple syncope; no convulsive movements having taken place. In most, it is a struggle to the last.

For some time after respiration has ceased, the heart continues to beat; it is the *ultimum moriens*, in this instance. It might be supposed that the air distending the heart, would clog its action; and that death would begin there. But it is not so. The mode of death would seem to be the following:—The blood, becoming mingled with air, assumes a frothy character, in the right ventricle, and thence is sent through the pulmonary artery; but is more or less arrested in the pulmonic capillaries, or terminal branches of the pulmonary artery, in consequence of the right ventricle being unable to overcome the mechanical obstacle presented by air bubbles in these vessels. The quantity of blood transmitted through the lungs, for the systemic circulation, grows less and less; according to the increase of obstruction and arrest in the lung's capillaries. The supply to the head is inadequate to afford due stimulus to the nervous centre, and syncope results. If circulation be not restored, the syncope continues; the respiratory movements then cease, and life becomes extinct; the heart last failing in its action, from want of its necessary stimulus, the blood.

When operating in the dangerous localities of the neck and trunk, care should be taken to prevent this accident. The chest and abdomen may be tightly bandaged, previously to the commencement of the operation, during its performance, and for some time after its completion; to prevent deep inspiration—the state most favorable for the air's entrance. But the employment of anæsthesia may secure a like favorable tendency, more simply, and with equal certainty. The larger veins should be avoided as much as possible by the knife; and when cut, of necessity or by accident, means should instantly be adopted to prevent the occurrence of those circumstances which are favorable to canalization. Perhaps the most effectual means is to shut the orifice by an assistant's finger, until the operation is completed. If deep inspiration, canalization of the cut vein, and access of air, be all prevented, the patient is safe—at least from this danger.

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[1] Edinburgh Medical and Surgical Journal, January, 1844, p. 6. Erichsen.

Air having entered, as indicated by the peculiar noise, and the alarming symptoms which immediately follow, instant and firm pressure is to be made on the venous orifice, or orifices, and accurately maintained, so as to prevent further ingress. The application of ligature should be avoided if possible; and when there are plenty of assistants, its use can never be imperative. Then, our attention is to be directed to prevention of the fatal result. The first indication is, to maintain due exercise of the cerebral functions, by furnishing, if possible, a suitable supply of arterial blood. For this purpose, we must husband the small available systemic circulation; determining it to the head, and leaving the rest of the body for a time but barely supplied. The patient is to be placed recumbent, with the head low, as in ordinary syncope (p. 321); by compression of the abdominal aorta, and both axillary arteries, the blood is limited in circulation to the upper part of the body; or, if obesity render pressure on the aorta difficult, both femoral arteries are to be compressed. The second indication is, to maintain the action of the heart, by artificial respiration, and friction at the præcordial region; thereby affording time and opportunity for removal of the obstruction in the pulmonic capillaries, and consequent restoration of the normal circulation. Should we thus succeed in averting the immediately fatal result, means must be taken to prevent or moderate the accession of inflammatory affections of the lungs, which are apt to ensue.

Air forcibly injected into a vein, as by insufflation, produces death almost instantaneously. In this case, death commences in the heart, which is distended and paralyzed by the large amount of air forcibly intruded. Such an event is not likely to occur, however, in the human subject.

John Hunter, on Inflammation of the Veins (Trans. Med. Chir. vol. i), Lond. 1793; Hodgson, on Diseases of the Arteries and Veins, Lond. 1815; Longuet, Sur l'Inflammation des Veines, Paris, 1815; Travers, on Wounds and Ligature of Veins, Lond. 1818; Brodie, on Treatment of Varix, Med. Chir. Trans. vol. vii; Breschet, de l'Inflammation des Veines, Paris, 1819; Ribes, Exposé des Recherches sur la Phlebite (Revue Med.), Paris, 1825; Dance, de la Phlebite, &c. (Archives de Med.), Paris, 1828–29; Arnott, on Inflammation of the Veins, Lond. 1829; Cruveilhier, Dict. de Med. Pratiq. (Art. Phlebite), tom. xii, Paris, 1834; Lee (Robert), Cycl. of Pract. Med. (Art. Veins, Inflammation of), Lond. 1834; Lee (Henry), on the origin of Inflammation of the Veins, &c., Lond. 1850. See Crisp, Otto, Rokitansky, Hasse, as under Diseases of the Arteries. See also Pyæmia. On the subject of Air in the Veins, see Cormack, Edin. 1837; Wattmann, Vienna, 1843; Erichsen, Edin. Medical and Surgical Journal, Jan. 1844; and John Reid's Anatomical, Physiological, and Pathological Memoirs, Edin. 1849.

CHAPTER XVI.

AFFECTIONS OF THE LYMPHATICS.

ANGEIOLEUCITIS.

Angeioleucitis, or *Lymphangitis*, is of very frequent occurrence. It may appear without any appreciable cause; more commonly it is the result of external injury. The superficial lymphatics are most frequently involved. And the inflammatory process seems, in the great majority of cases, to be connected with absorption of deleterious matter; either from without, or generated in the part as a product of the disease.

If a wound exist it becomes inflamed; and the affection has a tendency to the erysipelatous character. Painful sensations shoot upwards; and streaks or bands, of a bright redness, appear on the previously sound skin; not necessarily continuous with the original inflammatory process, but perhaps at some distance from it; tortuous, irregular, and intersecting each other, so as to form small islets of skin yet unaffected; following the course of the superficial lymphatics; and dependent on an erythematous condition of the skin above the inflaming vessels. Sometimes the limb presents an appearance as if attacked by slight erysipelas, at many unconnected points. The pain is hot and burning, and increased by pressure; and the vessels feel hard and corded. Swelling is usually considerable, often great; and affords a spongy sensation. The red streaks extend upwards, often with much rapidity; sometimes continuous throughout; but not unfrequently the skin shows intervals of apparent immunity. The ganglia, in their course, become involved; and swell acutely and painfully. Very frequently erysipelas supervenes; the distinct streaks of the angeioleucitis then becoming merged in the continuous redness of the new disease.

The general symptoms are usually ushered in with rigors, and at first evince the true inflammatory type. Sometimes a simply febrile state, as in erysipelas, precedes the appearance of local disorder. As the latter advances, the inflammatory type of the constitutional symptoms is more or less rapidly departed from; and, in the great majority of cases, at all severe, the irritative or typhoid characters are ultimately developed. Sometimes such is the type of the general disorder from the beginning; dependent partly on previous weakness of system; partly, as in all advanced cases of the disease, on the introduction of deleterious matter into the circulating system—a product of the inflammatory pro-

Resolution may occur; the process stopping short of suppuration; and the part gradually recovering from acute infiltration. Or the affection, either originally or secondarily of a chronic form, may cease: and yet resolution may not ensue; the part remaining indurated, and absorption of fibrinous deposit taking place very tardily, if at all. Or the process, acute, proceeds to suppuration; and this may occur within the vessels, or in the areolar tissue exterior; usually in both. In the former situation, the existence of pus is not so readily detected as in phlebitis. There is no fluctuating swelling; but there is the accession of a similar train of alarming typhoid symptoms, dependent doubtless on the same cause—the admixture of purulent or puriform secretion with the general circulation. External suppuration is indicated by the ordinary signs; sometimes assuming the character of abscess, or of a chain of abscesses; more frequently, perhaps, the matter is diffusely infiltrated, the general symptoms becoming aggravated in consequence. In unfortunate cases, the fatal issue is doubtless attributable to suppuration; more especially that from the vessels themselves.

Treatment is in the first instance actively antiphlogistic; but under the same restrictions as inculcated in the case of phlebitis (p. 581). In addition to the ordinary means, of leeching, rest, regimen, purging, &c., much relief is often obtained from assiduous application of a hot and weak solution of acetate of lead and opium to the part affected. When external suppuration occurs, whether diffuse or limited, the matter should be evacuated by early and free incision. In the chronic form, threatening to leave induration, blistering is advisable. In acute and aggravated examples, the same principles must guide as in the analogous case of phlebitis; support of the constitution, mitigation of the symptoms, and hope in the system's effort at revulsion and recovery. In those cases in which the constitutional disorder is from the first asthenic, active antiphlogistics are never expedient.

Not unfrequently, erysipelas, phlebitis, or even both, coexist. Such addition renders the prognosis unfavorable; and demands modification of treatment, to suit the circumstances of complication.

Inflammatory swelling of the lymphatic ganglia, as already stated, attends the spread of angeioleucitis. But, besides, it often occurs independently of such preliminary disease; the result of excitement; either direct or conveyed from a distant part; and connected or not with absorption of deleterious matter. Simple strain, or ulcer, or wound of the foot, for example—as well as direct injury of the part itself—often induce acute inflammatory swelling of the inguinal glands; and the same parts are quite as frequently affected in an inflammatory process, more troublesome if not more intense, from ulceration of the penis of a specific kind, accompanied by absorption of venereal virus.

The swelling is rapid, prominent, and very painful; attended with more or less constitutional disturbance, of the inflammatory type. The bulk mainly depends on infiltration of the parenchyma, or ordinary areolar tissue of the gland in which the inflammatory process would seem chiefly to reside. The conglomerated tubes themselves undergo change, such as usually results from acute inflammatory affection of that tissue; alteration of the coats, and of the secretion; perhaps suppuration; seldom obstruction—a circumstance very fortunate, in regard to continuance of the important function of absorption. The infiltration of the parenchyma may be simple and plastic; soon disappearing, by absorption, on subsidence of the disease. Or suppuration takes place; and abscess forms, either in the substance of the gland, or in the areolar tissue on its exterior. Or the deposit, continuing plastic, does not resolve on subsidence of the inflammatory process; but continues, forming an indolent and firm enlargement.

In most cases—more especially those of simple excitement, unconnected with absorption of deleterious virus—it is our object to arrest the process and obtain resolution. Local depletion, by leeching, is naturally had recourse to; but experience says little in its favor. There are comparatively few examples of its apparent success; on the contrary, the irritant effect of the application seems rather to hasten the process onward. If leeching is employed, let it be at a little distance from the part affected. Usually, however, more trust may be reposed in other antiphlogistics; rest, fomentation, relaxing position, antimony or aconite, and low regimen.

If the crescent affection be of the subacute form, benefit may often be obtained from the endermic application of iodine, in solution, so as to desiccate and decolorize the integument (p. 158). Many a simple and subacute bubo may be thus arrested; at the same time maintaining rest and antiphlogistic regimen.

When matter has formed, incision is to be made as under ordinary circumstances. The suppuration is usually both profuse and long-continued. Poulticing and fomentation are employed for a few days; then water-dressing, medicated or not, as circumstances may require. And ultimately pressure is advisable; to hasten absorption of fibrinous infiltration in the gland's parenchyma, and at the same time to favor closure of the suppurating track and cavity.

If suppuration have taken place only in the subcutaneous areolar tissue, the skin is usually considerably undermined. The opening becomes large, and closure is delayed by projection and interposition of the yet entire glandular tumor. In such circumstances, pressure is to be tried; directed with some energy on the offending part. And if this fail, potassa fusa should be freely applied to the interior of the enlargement, as if by transfixion; so as to insure entire suppuration and consequent disintegration of the mass (p. 58). Thereafter, the sore is to be treated in the ordinary way.

Sometimes a glandular enlargement, originally acute, ceases to be so; and hangs undecided between progression and recedence. For this state nothing is so suitable as an active blister. It decides the question in one way or other; either absorption or suppuration follow.

In the truly indolent swellings, pressure is employed, with occasional counter-irritation; and the iodide of potassium is given internally. Where constitutional debility exists, the iodide of iron may be preferable; and cod liver oil is often of great service. Should the method by discussion fail, both part and system may be continuously stimulated, so as to induce suppuration in the changed part.

Buboes, of venereal origin, are amenable to certain peculiarities of treatment, as will afterwards be noticed.

Glandular Tumors.

Nothing is more common than enlargement of the lymphatic ganglia. But the great majority of such swellings have their origin in simple inflammatory affection; never requiring the extirpating knife; always amenable either to discussion or to suppurative disintegration. Occasionally, however, the glandular parenchyma is the seat of genuine tumor; perhaps supervening on simple inflammatory enlargement; more frequently wholly independent of this. In the latter case, one or two glands only are affected; not a whole cluster or chain. The growth is more steady, the swelling more distinct; and, in other respects, the characters of the enlargement are such as belong to tumors generally—as has already been described (p. 269).

For Literature, see references under Inflammation and Scrofula.

CHAPTER XVII.

AFFECTIONS OF THE NERVES.

NEURITIS.

THE effects of the inflammatory process on this tissue are, of course, most apparent in the nervous centres; but there seems no reason to doubt, that similar effects follow similar causes in the nervous ramifications also. The first change is tumescence, with increase of the supply of blood. On making a section of the affected part, numerous red spots are seen, marking the bloodvessels; and in some places there may be a red striated appearance, in consequence of extravasation; sometimes small coagula are found. The increased amount of blood may heighten the general color of the affected part. The cortical substance assuming a dark red or brownish color, while the medullary is of a lighter tint. The process continuing, the ordinary exudations result; the tissue softens, and may become of almost semifluid consistence. According to the nature and extent of exudation, the color, density, and general character vary; if blood be extravasated, the softening is red; yellow, when this is not the case; sometimes gray, and occasionally whitish, or but little altered from the normal hue. The latter condition, as can readily be understood, is the result of a chronic and minor affection.

The cineritious matter is more prone to undergo such changes than the medullary; probably on account of superior vascularization.

Softening of nervous substance, found after death, may be unconnected with the inflammatory process. The distinguishing of such post-mortem disorganization from that which is truly inflammatory, sometimes requires minute and careful examination. Generally speaking, the former is more diffused, or, if localized, has an obvious cause in the presence of dropsical or other fluid leading to mechanical disintegration of the tissue. Under the microscope, nothing is found but disorganized and macerated nervous texture; while the inflammatory softening is characterized by the presence of exudation corpuscles and granules.

The nervous tissue is not exempt from suppuration. The matter may be intermingled with broken-down nerve tissue, as in the more recent forms of softening; or limited as in ordinary abscess, by its cyst, and by condensed tissue around. The abscess may be acute; following the ordinary course, and marked by symptoms of great intensity; or chronic, most insidious in its progress, and consequently of a highly dangerous character.

Induration and enlargement of structure follow chronic inflammatory disease; and are usually the remote result of some injury done to the part.

Ulceration is doubtless concerned in the process of softening; peculiar to acute inflammation. And in progressive ulcer wherever situated, nerves, though for a time resistful of the destructive process, ultimately give way before it. Sometimes ulcer seems to originate in the nerve, giving rise to most untoward symptoms; when for example, that tissue has become the seat of inflammatory affection subsequently to laceration, bruise, or other similar injury.

Gangrene is comparatively rare; yet may occur, as in other parts. The nerves of a limb slough and separate, as do the other component textures; and sloughing of the protruded cerebral mass is far from uncommon in *hernia cerebri*.

The *Causes* of the inflammatory process in nerves are usually traumatic; puncture, section, laceration, bruise, inclusion by ligature. The idiopathic form is rare.

From simple wound, a minor and somewhat chronic grade of the process usually results; producing bulbous expansion of the cut end of the nerve, by deposit of plastic material between the fibrillæ, and corresponding hypertrophy of the investing neurilemma; a condition termed *Neurama*, when the swelling is of considerable size, and the seat of abnormal sensations. A similar result usually follows injury by deligation. Puncture, laceration, and bruise, are more likely to be followed by true inflammation; producing softening and suppuration, ulceration, or even death of the part.

The *Symptoms* which attend inflammatory changes in nerves are, in the acute form:—great pain, rendered excruciating by pressure, and shooting in the direction of the nerve or nerves affected; heat and throbbing; not unfrequently a tendency to jerking of the muscles implicated; inflammatory fever of a marked and intense character; and, in the more urgent cases, the nervous centres are apt to be involved in obvious derangement of function. In chronic examples, such as result in the formation of neuroma, the pain may be equally severe, but is not so much aggravated by pressure; heat and the ordinary signs of acute inflammation are absent; and the system is not involved in inflammatory fever, but rather wasted by disorder of adynamic type, resembling an ordinary hectic. If neuroma form and be superficial, the painful, hard swelling can be distinctly felt.

Treatment is conducted according to ordinary antiphlogistic principles; activity being proportioned to the nature and urgency of the case. *Cœteris paribus*, the nearer the part affected is to the nervous centres, the more important is the case, and the greater the expediency of active measures for relief.

Neuralgia.

This denotes increased and perverted sensation in a nerve; unconnected with the inflammatory process, or with change of structure, at the part where the pain is felt. The affection is of two kinds, as formerly stated; entirely functional, being unconnected with organic lesion, at any part of the nerve's course, or at the nervous centres; or, as more frequently happens, connected with organic change, acute or chronic—more frequently the latter—at some part of the nerve's course, or at the nervous centres. The one is an example of pure irritation, or functional nervous derangement; the other may be termed—irritation, dependent on organic lesion at a distant part of the nervous tissue (p. 76). The nerves most liable to neuralgia are the fifth pair, and the sciatic; the former more especially. But all are apt to suffer. Neuralgia may be anywhere; in the head, face, arms, chest, abdomen, back, legs, or feet.

The pain is intense, but intermittent; sudden in its onset, also abrupt in its decadence; shooting or plunging in its character, and often quite excruciating; readily induced by the slightest external impression affecting the mere surface; but seldom aggravated by firm pressure on the part; on the contrary often relieved thereby. Occasionally, delirium seems to ensue from mere severity of suffering. Tic-douloureux—affection of the fifth nerve—in the face, is a familiar example of the gravest form. Not unfrequently, the attacks are periodical and regular in their accession; and muscular spasm is a common attendant on the paroxysm. Some neuralgic patients suffer especially in certain months of the year.

Rheumatic pains not unfrequently follow the course of the nerves; dependent on affection of the fibrous neurilemma. But such pains are not truly neuralgic. They are less intense, less intermittent, less paroxysmal, and associated with the ordinary rheumatic accompaniments.

The *Cause* of Neuralgia is usually obscure. There may be no organic change in any part of the nervous tissue, as already stated; and the origin of the purely functional derangement may prove quite inscrutable. Or there may be disorder of some internal organ; apparently connected with the neuralgia, in the relation of cause and effect; the latter disappearing, when the former has been removed. A neuralgic pain of the leg or foot, for example, has often yielded to treatment directed to removal of noxious matter from the intestinal canal, with restoration of the normal secretions.

Sometimes the neuralgia seems dependent on an irritation, less formidable than itself, in a different part of the same nervous expansion. Violent neuralgia of the infra-orbital nerve, for instance, is often assuaged, or perhaps cured, by removal of a decayed or otherwise altered tooth, which may have been occasioning but little apparent disturbance in its own immediate vicinity.

A spiculum of bone, or mere enlargement of an osseous canal, may so compress and irritate a passing nerve, as to induce neuralgia in its extreme expansions. And it is supposed, with probability, that similar results may follow compression of a nerve in an osseous canal in consequence of change in the accompanying bloodvessels—expansion, by local determination—independently of any alteration in the osseous texture.

Very frequently organic change, existing at some part of the nervous tissue, may reasonably be judged the cause of the neuralgia; a thickening or enlargement of the nerve, at some part; or a disorganization, or congestion, or effusion, at some part of the nervous centre, near the origin of the nerve or nerves affected. In chronic disease of the upper part of the spinal cord, and lower and posterior part of the brain, there is no more frequent or distressing class of symptoms than plunging neuralgic pains, with muscular spasms in the lower limbs.

But, whatever the exciting cause, there seems to exist some predisposing origin of neuralgia, which we cannot define; a constitutional tendency to the disorder, which may, and does, of itself maintain the malady, after every appreciable cause has been sought for and removed; and which doubtless is the sole origin, in those cases in which no exciting cause can be detected even after death. In the case of neuralgia, apparently dependent on neuromata, for instance, these may be taken away by incision, and the wound treated most carefully; yet the same painful feelings are very prone to return, before fresh neuromata have had time to form; and may continue, even when careful manipulation satisfies the surgeon that additional neuromata have actually not been produced.

Hysteria obviously predisposes to the disease, and may sometimes also prove its exciting cause. But in these cases the pain is not so apt to follow the course of nerves, but rather to settle on the surface of a part, or even in an internal organ.

The termination of the disease is not uniform. It may yield to treatment. Frequently it defies all remedies, and suddenly disappears spontaneously; the cause of decadence proving still more mysterious than that of accession. Or continued irritation may induce serious change in the nervous centres; and the result may be apoplexy, or insanity. Or the irritation may simply exhaust the patient, by emaciation and hectic.

Treatment.—Our first and most obvious duty is, to anxiously seek for, and detect a cause, if possible; and, having found it, to effect its removal, if this be in our power. Disorders of the uterus are to be remedied; intestinal irritation, by lodgment of noxious matter, or otherwise, is to be subdued; dyspepsia is to be remedied, if possible; offending teeth or stumps are to be extracted; neuromata, or painful subcutaneous tubercles, are to be excised; foreign matter, lodging in the neighborhood of the nerve, is to be carefully taken away. If chronic change of structure be suspected in the substance of the nerve, at some distant point, let moderate leeching, followed by patient counter-irritation, be employed at that part, with the view of remedying such change; assisted, if need be, by the internal use of iodide of potassium, or other auxiliaries to discussion. If the brain or spinal cord be suspected, treatment should be mainly directed to these important parts. It is not uncommon to find neuralgia connected with great tenderness of certain vertebræ; and such cases often yield readily to leeching there, followed by counter-irritation, and rest.

To the seat of pain, various applications may be made. In some cases, it has been thought that good has resulted from use of the moxa or actual cautery; but such remedies are more suitable to those parts where actual change of structure is either known or suspected. Soothing applications are more appropriate to the seat of neuralgic pain. Opium, belladonna, aconite, may be used in the form of epithem, ointment, or liniment; or their salts may be exhibited by the skin—either by inoculation, or after abrasion of the cuticle by vesication. Veratria and hydrocyanic acid are also not without their effect as local anodynes. Simple blistering, dry cupping, and rubefacients sometimes afford relief.

Internally, anodynes may be given. In some cases, it is of the utmost importance to palliate in this manner, without any expectation of cure; preventing exhaustion of the frame from continued intensity of pain. Opium may thus be found useful in large doses; and yet it should always be used warily, lest it accelerate and avate the cerebral disorder which the disease itself tends to induce nhalation of chloroform may sometimes abate a paroxysm; and can at all times command temporary relief from suffering.

Not a few remedies are exhibited internally, almost with empiricism; considered available to counteract that hidden perversion of system, on which neuralgia seems much to depend. Subcarbonate of iron is given in large doses; along with occasional laxatives, to prevent the bulky medicine from accumulating in the interior. It is especially useful in those cases, in which the disease is obviously connected with an anæmic condition (p. 327). Quinine and arsenic are both of much repute, especially in those cases in which periodical accessions are most marked. Colchicum is likely to be serviceable, when a suspicion exists of rheumatic origin or complication. Turpentine, too, has proved of use; especially in affections of the sciatic nerve. Croton oil, used as a smart purgative, has often afforded relief; perhaps on the principle of counter-irritation.

Stimulants of the nervous system have been tried, and with some success. Relief has followed the application of electricity and galvanism directly to the nerves, by means of acupuncture; and the internal use of strychnia, in doses of the twelfth of a grain, has also effected alleviation.

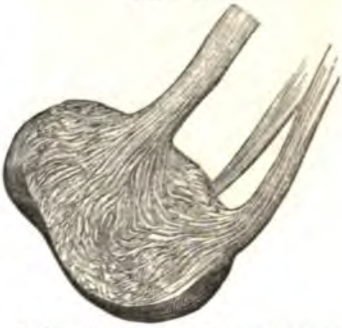
In all cases, it is most important to commence the internal treatment by evacuants, followed by alteratives; and to persevere in the simple use of these, until the primæ viæ exhibit satisfactory evidence of a normal state, as to contents and secretion. There are but few cases, also, which will not receive benefit by cessation from laborious and anxious avocations, with change of air; more especially if the change be from a humid, relaxing climate, to one which is dry and bracing.

Interruption of continuity in the affected nerve by excision of a portion, has been tried extensively; but with so little success as scarcely to warrant repetition of the experiment. In many cases relief is obtained for a time; but soon there is restoration of the nerve's function, if not of its absolute continuity of structure; and the pain returns, perhaps in an aggravated form. Excision, therefore, is now prudently limited to those cases, in which an obviously altered portion of the nerve affected can be safely and completely taken away.

Tumors of Nerves.

All tumors are liable to occur in connection with the nervous tissue; but two are peculiar to it, the *Neuroma*, and *Painful tubercle*.

Fig. 204.



Section of a neuroma; three nervous trunks terminating in it. The fibrous arrangement shown, as observed by the naked eye.—SMITH.

Neuroma.—This is a simple tumor, and, like the painful tubercle, is of the nature of fibro-cartilage; consisting of dense plastic matter lodged amongst the fibrils of the nervous tissue, which are thereby separated, and usually rendered the seat of perverted sensation. Sometimes, the formation occurs spontaneously; more frequently, it follows remotely on wound, or other external injury. It may take place in the course of an undivided nerve; more frequently, it forms on the truncated extremity, after division. When in the former situation it usually arises without any appreciable cause; is of an oval shape; and may attain to the size of a prune or small egg. Above and below the enlarged part, the nerve resumes its wonted form and appearance.

Fig. 205.

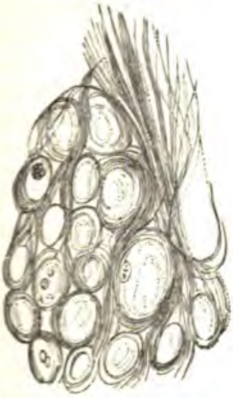


Fig. 206.

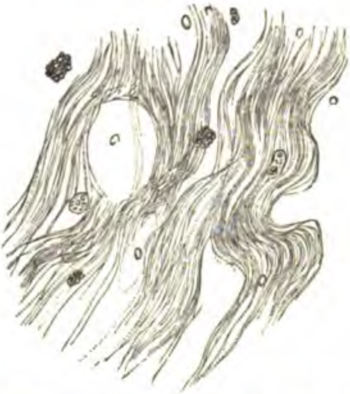
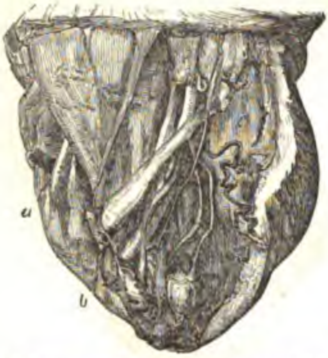


Fig. 205. Microscopic section of subcutaneous tubercle, showing fibro-cartilaginous structure. Corpuscles abundant.—*From a drawing by Dr. Bennett.* Fig. 206. Fibrous structure of neuroma; from the case published by Dr. Smith of Dublin. After immersion in spirit, which has caused corrugation of the granules and corpuscles.—*Also from a drawing by Dr. Bennett.*

After wound, as on the face of a stump, neuromata vary in size, according to the original dimensions of the nerves affected. The nerve itself, for some way above, is also slightly increased in bulk, tortuous, and unusually vascular. Under all circumstances of healed wound, the cut portions of nerve undergo an enlargement and condensation. And it is probable that the neuromata are caused by a similar process and change of structure, which have transgressed the limits of expediency. The ordinary bulbous end of cut nerve, in a stump or other wound, is not painful or inconvenient; but the neuroma—an exaggeration of this—is both, to a very great degree. Besides, the neuromata, in a stump, are in general intimately incorporated with the hard cicatrix; which is tightly adherent to the bone and its dense investing textures. And this circumstance, of itself, might be the cause of much irritation to the nerves which it implicates; even if these were otherwise but little altered in structure.

Fig. 207.



Neuromata of stump, after amputation of the arm. A large neuromatous mass at *a*; opposite *b*, the tumors are more defined.

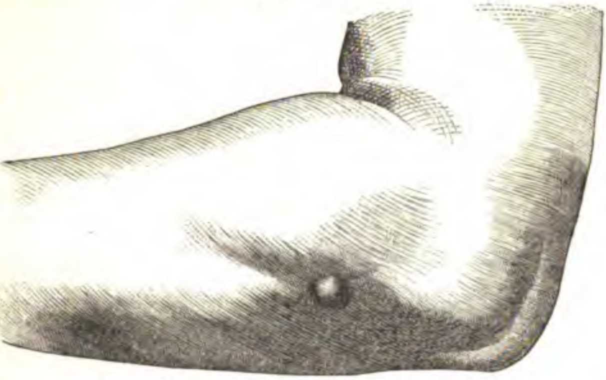
The pain of neuromata is great, though not constant; increased by pressure; often presenting all the characters of intense neuralgia; embittering exsitence, and greatly deranging the general health. Epilepsy has been known to follow, apparently, from this cause; hysteria, not unfrequently.

The remedy is by extirpation. In the case of neuroma formed on undivided nerve, the swelling is cut down upon and exposed; and, the nerve having been cut across by a finely-edged knife, at a little distance above and below the enlargement, the diseased part is dissected away from its surrounding attachment; to which, usually, it but loosely adheres. This entails paralysis of that nerve for a time; but the structure is reproduced, and function restored, more or less completely. And, even were it otherwise, surely the absence of all sensation were preferable to pain of an excruciating intensity. In the case of a stump, or other wound, if there be one or two distinct and circumscribed tumors, they may be removed in a similar way. But, usually, they are numerous, and intimately incorporated with the dense ligamentous structure forming the cicatrix. And, under these circumstances, a second amputation is necessary; taking away all the neuromata, as well as the changed structure in which they are inextricably impacted. In doing so, the nervous section should not only be effected with a finely-edged instrument, but should be made higher than that of the other tissues; in order to make sure that the cut extremities shall not again become entangled in the cicatrix. Sometimes, however, notwithstanding all care in such particulars, the neuromata, or at least the neuralgic pains, return; a circumstance apparently attributable rather to a constitutional than to a local cause, and demanding general treatment accordingly.

That such neuralgic diathesis exists, experience has made but too plain; often neutralizing the results of operations otherwise most promising. And the liability to such a perverted state of system must always be borne in mind, in reference to treatment and prognosis. But a still more formidable diathesis is found occasionally to occur; productive not of neuralgic pains but of neuromatous tumors, throughout the whole body; as in the remarkable cases related by Mr. Smith of Dublin. Such general disease is manifestly hopeless, under any treatment.

Painful Tubercle.—This is often termed also *Subcutaneous;* its most frequent site being the areolar tissue, immediately beneath the skin; and sometimes the integument also seems to be partially involved. Occasionally, however, it is found in the intermuscular areolar tissue. The size seldom exceeds that of a pea or bean; and is often less than either. The structure appears very similar to that of the neuroma; but often more dense; and sometimes containing points, if not actually bloody, at least of a blood-like appearance. This last condition, however, may be accidental; the result of external injury. And probably it is so; for the structure, in all other respects, seems to be simple and benign. Another difference from the neuroma is, that whereas in the latter the nervous fibres are very apparent, here the fibrous matter seems to be mainly, if not wholly, a new production. No nervous trunk is continuous with the mass; only the minute terminal branches are capable of being traced into it. The tumor is very movable; gliding under the finger. But it is intolerant of the slightest pressure; intense pain being produced thereby. The pain sometimes assumes the form of paroxysms; induced by the slightest external influence, and sometimes of spontaneous origin. More frequently than the neuroma, it has been associated with hysteria; but, usually, the general health is less disordered than in neuroma. It may occur in any part of the general surface; but is most frequent in the lower extremities.

Fig. 208.



Painful subcutaneous tubercle, on the fore-arm.—SMITH.

Treatment is by excision. If the skin be at all involved, it is to be taken away along with the tumor, to the requisite extent, by means of elliptical incision. If the integument be free, a simple wound suffices. There is no reproduction. Some general means may be subsequently expedient, to calm the nervous system from excitement, which the existence of the tumor may have induced.

In connection with Affections of the Nerves, see Elliotson, Cycl. of Pract. Med. (article Neuralgia), Lond. 1833; Lee, on Nervous Disorders, Lond. 1833; Brodie, on Local Nervous Affections, Lond. 1837; Allnatt, on Nervous Affections, Lond. 1843; Bennett, on Inflammation affecting the Nervous Centres, Edin. 1843; Hunt, on Neuralgic Disorders, Lond. 1844; Wood, on Painful Subcutaneous Tubercle, Edin. Med. Chir. Trans. vol. iii, part ii; Smith, on Neuroma, Dublin, 1849; Paget's Lectures, Med. Gazette, July, 1851; separately published 2 vols. 1853. See also references, p. 97.

INJURIES.

CHAPTER XVIII.

OF WOUNDS.

The term Wound need not be defined. It is used in surgery in its ordinary acceptation. Many such injuries are the result of accident; others, of design. They vary in extent and importance; from a mere scratch, to the amputation of the hip-joint. But, indeed, all are important; and should never be regarded either as trivial, or as matters connected with a part alone. Those apparently most simple may involve, ultimately, much suffering and danger. Hemorrhage, erysipelas, gangrene, hectic, tetanus, may occur; bringing life and limb into the most imminent peril.

Wounds are of different kinds; and, classifying them, we speak of Incised, Contused, Lacerated, Punctured, Poisoned, Gunshot, and Subcutaneous wounds.

1. *Incised Wounds.*

These are inflicted by a sharp-edged, cutting instrument. They are the most simple and favorable kind of injury; being the most capable of speedy union by adhesion, and least liable to inflammation or other accidents. Their surface is greater than their depth; and they are free from laceration and contusion. Their most prominent symptom, and greatest danger, is hemorrhage, especially the arterial; a subject which has already engaged our attention (p. 305).

In the treatment, our first care, as formerly stated, is to arrest the hemorrhage. Our second, is to remove foreign matter which may be present. The third, is to arrange and superintend the wound; so as to favor the mode of union which, under the particular circumstances of the case, we consider most desirable.

The treatment of wounds has been greatly simplified, and improved, of late years. In the beginning of the seventeenth century, Cæsar Magatus, an Italian surgeon, exerted himself in this way; and about a century later, Boccacini warmly supported the practice of his countryman, especially forbidding all greasy or oily applications. But neither of these surgeons seem to have had many followers. And it was not until the middle of the eighteenth century, that our own Percival Pott—abolishing the maxim, "Dolor medicina doloris;" explaining Nature's powers and mode of healing; adapting surgical treatment so as to assist these; discarding the painful and unnatural practices opposed to them, howsoever dignified and guarded by the cloak of antiquity; and so establishing a system at once more rational and less severe—achieved a most important reform in the practice of his profession. His immediate successor, the great John Hunter, by his valuable expositions of the natural processes in both health and disease, and more particularly of the doctrine of adhesion, confirmed the practical reforms of Pott, and stimulated the profession to cultivate and extend them. The gradual result has been, that, amongst other important improvements in surgery, the treatment of wounds has now become as efficient as it is simple and humane.

Simplicity, however—which may usually be considered an index of the degree of perfection, in almost all surgical proceedings—is of very recent date. Within these few years, the dressings of wounds, though stripped of pain and cruelty, were unnecessarily numerous and complex, and likewise but ill calculated to forward the object for which they were employed. A routine system had been so long followed, that practitioners seemed never to dream of another. All wounds "were put together without delay; and their edges, having been squeezed into apposition, were retained so by various means, such as sutures, plasters, compresses, and bandages. They were carefully covered up, and concealed from view, for a certain number of days. Then, the envelopes of cotton and of flannel, the compress cloths, the pledgets of healing ointment, and plasters were taken away; loaded with putrid exhalations, and with a profusion of bloody, ill-digested, fetid matter. A basin was forthwith held under the injured part, and the exposed and tender surface, having been deluged with water from a sponge, was well squeezed and wiped. Then came a reapplication of retentive bandage, of the plaster, of the grease mixed with drying powder, all surmounted by some absorbent stuff, as charpie or tow, to soak up the discharge. This was not unaccompanied with pain—often more complained of than that attendant upon the original injury or operation. The process was repeated day after day. The patient was kept in a state of constant excitement; and often, worn out by suffering, discharge, and hectic fever, he fell a victim to the practice. The system was a bad one—the applications filthy and abominable—the whole proceedings outraged Nature and common sense. The wound was, as it were, put into a forcing bed; excited action, beyond what was required, was hurried on, and the consequence was that speedy union seldom, if ever, could or did take place. On the contrary, a suppurating surface was formed, with profuse discharge; and a very tedious cure, if any, was obtained."[1]

Treatment for Adhesion (p. 175).—Hemorrhage having been stanched—and the wound cleansed, gently and carefully, from foreign matter, if need be—coaptation is to be thought of. And a question immediately arises, as to when and how that is to be accomplished. Formerly, as has been already stated, it was the practice to make the coaptation both immediate and complete; but, now, temporary delay and incompleteness are deemed expedient. If the external wound be put together while oozing of blood continues, even though slightly, and more particularly if it be covered up by lint and bandaging, adhesion cannot but be thwarted. For, supposing that the bandaging fails instantly to arrest the oozing—as is most likely—the blood, unable to escape, accumulates in a coagulum, which occupies the cavity of the wound; separating the cut surfaces to a greater or less extent; and enacting the part of a foreign substance, as effectually as would lint, or charpie. Besides, the coagulum resembles a hot sponge, in contact with the cut vessels; and as the collateral circulation becomes more and more fully developed, in consequence of deligation of the principal arterial trunks, hemorrhage is most plainly favored, from vessels which otherwise would have been permanently closed by natural hemostatics. Complete undoing of the coaptating means, exposure of the wound throughout its whole extent, removal of the interposed coagulum, arrest of the hemorrhage, and subsequent reapplication of the dressing become necessary; proceedings not only very painful to the patient and irksome to the practitioner, but also most opposed to the occurrence of adhesion; for a part, so stimulated by fresh manipulation and injury, can scarcely escape inflammation. And even should bleeding not occur to such an extent as to demand reopening of the wound for its arrest, still the mere lodgment of a coagulum forces on the inflammatory process, and suppuration becomes established. Seeking adhesion, it is our object to have no accumulation of clotted blood between the cut surfaces; to have no necessity arising, by hemorrhage, for reopening the wound; and to avoid all exciting causes of true inflammation. These indications are fulfilled, by delaying all attempts at closure, for some time, in wounds of moderate extent; and, in those of large dimensions, as after amputation, making the immediate approximation only incomplete. The oozing thus escapes externally, without accumulating within; means are in operation to arrest it—namely, the application of styptic influence by atmospheric exposure, or by cold irrigation; and should a vessel prove troublesome, it can be secured with comparatively little trouble or pain. In a large wound, one or two stitches are applied; to prevent exposure of the whole raw surface, and to facilitate subsequent approximation. The minor wounds are untouched by needle, strap, or bandage. They are loosely covered with a thin portion of lint, wet in cold water; and, by its means, application of cold is made continuously, either by alternations of such pieces of wetted lint, or by irrigation.[1] By such treatment, not only is oozing more speedily arrested, and the formation of an interposed coagulum prevented; but, also, nervous and vascular excitement are repressed; consequently, a rise towards true inflammation is opposed (p. 174); and the minor grade of the process, favorable to adhesion, is secured. Besides, the collateral circulation, tending to reopen the smaller arterial orifices, is moderated; and recurrence of bleeding is rendered improbable.

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[1] Liston's Practical Surgery, p. 31.

[1] The following is a convenient mode of applying the cold irrigation; by suspending a bottle of cold water in a suitable position as regards the part; and "placing in it a few threads of lamp cotton, one extremity of which should reach to the bottom of the bottle, the other hang out at its mouth." In this way a species of syphon is obtained, with a constant dropping on the lint which invests the part.

After a time—in some cases, a few minutes only suffice—all oozing ceases, and the cut surfaces become of a glazed appearance. The liquor sanguinis has already begun to exude; the solid part remaining in contact with the wound, the serum trickling away. Then is the favorable opportunity for effecting complete coaptation; without any foreign substance interposed between the cut surfaces, and with the plastic material of reunion already in process of formation. By longer delay, we should probably incur the risk of undue excitement, from atmospheric exposure.

If it be objected, that when some considerable time elapses between the infliction of the wound and its final dressing, fresh and unnecessary pain is occasioned—such objection may be sufficiently met by the application of anæsthesia by chloroform. And this eluding of nervous excitement may be further of use, by rendering the accession of inflammation still less probable.

And now the question arises—What is the preferable mode of effecting accurate apposition of the wound? It is not the insertion of numerous, dragging stitches; the application of much impervious and irritating plaster; nor the pressure and heat of pledgets, compresses, and bandage. The object is not to pull, press, heat, hide, and irritate the parts; but simply to retain them in close yet easy contact. The principal agents of coaptation are, position and plaster; and, in many wounds, these alone are quite sufficient. But, in others, where there is loss of substance—or when, from any other cause, approximation is not easily effected—sutures are indispensable; otherwise the wound would gape, and could not adhere. Sutures are of different kinds. Those most commonly employed are termed Interrupted. A needle and thread are passed through the margins of the wound, so as to include the whole thickness of skin and a portion of areolar tissue; entering and emerging about a quarter of an inch from the line of incision. The thread is secured by a double knot; with sufficient tightness to make approximation complete at that point, yet not so tightly as to pucker the wound, or bruise the included textures. These sutures are to be as few in number as possible; indicating and facilitating apposition, rather than effecting it; and, in all cases, their use is temporary. By some, it is true, sutures are still wholly trusted to for coaptation. But it ought to be remembered, that the stitching is of living flesh, and not of an inanimate garment; that each suture is a fresh stimulus, prone to excite inflammation;

Fig. 209.

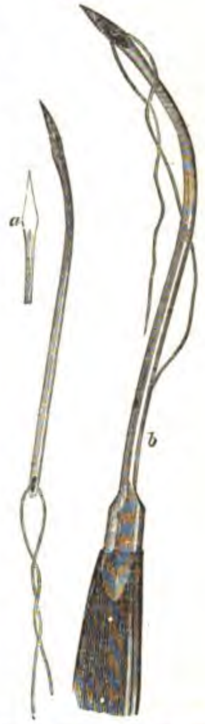


Fig. 210.

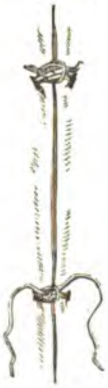


Fig. 209. Suture needle; with improved point, *a*. *b*, Needle in fixed handle; useful in tying erectile and other tumors. Fig. 210. The common interrupted suture. The knots not tightened.

and that if such stimuli be numerous and permanent, in a short space of wound, inflammation is all but inevitable. The living structure does not fail to resent the injury, and resists the lodgment of foreign matter in its substance. And, further, inflammation and suppuration of the wound itself, with delay of cure, constitute not the sole hazard; erysipelas, or diffuse areolar infiltration, may ensue; requiring active and severe treatment, and, even with that, perilling existence.

M. Vidal, in slight wounds, employs small spring forceps, about an inch and a half long, which are provided with blunt hooks at their extremities. They take a firm hold of the skin, without transfixing it, and are said to cause little or no uneasiness. Retained for eight or ten hours, the wound may have by that time adhered with sufficient firmness, to render all extrinsic retentive means unnecessary.

As already stated, position and plaster are the main agents of apposition. The part is placed, comfortably yet securely, so as to relax those muscles whose fibres, on the stretch, would naturally impede the object in view. The surrounding skin having been gently freed from hair and moisture, the edges of the wound are carefully and gradually opposed accurately to each other, by the hands of an assistant; who retains them so, while the surgeon applies strips of adhesive plaster over the line of wound. The preferable kind of plaster is that brought into use by Mr. Liston; consisting of a strong solution of isinglass in spirit, spread evenly upon oiled silk, or upon fine animal membrane, or upon silk gauze. The gauze is probably the best; first made water-proof by a coating of boiled oil, and then laid over with layers of the dissolved isinglass. The advantages of this kind of plaster are, that it does not irritate, while yet it adheres with much tenacity; not tending to encourage erysipelas, or inflammation of any kind; and entailing no trouble to the surgeon, pain to the patient, or injury to the part, by frequent renewal. Often the first application remains firm throughout the whole period of cure. Another obvious and important advantage is, that the plaster, being translucent, permits a surveillance of the whole track of wound; as complete as if no dressing whatever had been employed. The slips should be long; in order that, enacting the part of a bandage, they may support the whole wound, and prevent falling away of the cut surfaces in the deep as well as in the superficial portion; this being most especially necessary in large flap wounds, as after amputation. And this indication may be further fulfilled, while at the same time the main straps are rendered more secure, by one or two slips being placed round the limb, so as to overlap the extremities of the former. Interstices should be left between each of these; in order to permit free escape of the slight serous discharge, which oozes out during the process of adhesion. And, if sutures have been employed, these are left uncovered also; in order to facilitate their subsequent removal. When, after some hours, the plaster has become consolidated, the sutures may be dispensed with; in whole, or in part. If there have been a laxity of integument, with facility of apposition, they may be all gently removed, by section and withdrawal of each noose; but if there have been, and still is, some straining on the part, removal of the sutures should as yet be but partial, or altogether deferred. It being at all times borne in mind, however, that the sooner they are removed—without displacement of the wound—the more likely is adhesion.

When the process advances favorably under this treatment—as it will do in the majority of cases in which it can reasonably be expected—no other applications are required. All that is necessary has already been done; the wound is approximated, and retained so, under favorable circumstances; and further covering of it would only tend to thwart the occurrence which it is our wish to promote. All pledgets, cloths, and bandages, are therefore not to be thought of. It is sufficient to wipe away, as often as is necessary, the fluid which may exude from the dependent part of the wound. Thus, attention to cleanliness becomes the principal duty of the dresser in the after part of the cure; and to facilitate the performance of this duty, the wound, when extensive, as after amputation, is placed on a sufficient portion of oiled silk, from which the secretion that trickles down can be wiped away without any soiling of the bed linen. It is scarcely necessary to add, that there should be no washing or scrubbing, of either the wound or its immediate neighborhood.

In slight and superficial wounds, Collodion is an excellent means of retention; applied either continuously over the part, so as to make one unbroken covering; or, what is better, put on in strips across, like plaster, by means of a stroma of lint (p. 195).

Towards the end of the cure, it often happens, in large wounds, that more or less œdematous swelling takes place in the edges and the surrounding parts; after amputation, for example, this is by no means an unfrequent occurrence. To remove this, a plain bandage is necessary; lightly and uniformly applied, so as merely to support the parts; favoring absorption and venous return, without occasioning pressure or irritation. This is the first period when bandaging is really required; previously, the duty of coaptation has been efficiently performed by the plaster. And this is the only addition to the simple treatment by plaster, that is likely to become either expedient or necessary when adhesion is the mode of healing.

Exceptional cases, however, occur, as regards bandaging. When, for example, oozing cannot otherwise be satisfactorily controlled, the pressure of bandaging at the time of wound may be essential; to prevent the greater evil, by excessive loss of blood.

So far, the manipulations of surgery are concerned. But the constitutional treatment is equally necessary; rest, quietude, and rigidly antiphlogistic regimen. The last indication is especially important; and yet is often either disregarded, or inefficiently fulfilled. In an approximated wound, inflammation is the great enemy of adhesion (p. 99); and, unless regimen be kept of the most sparing kind, it can hardly be avoided. Immediately after the infliction of the injury, the patient should receive little or nothing in the way of sustenance; and all hot or otherwise stimulating fluids should certainly be prohibited; otherwise, hemorrhage by reaction is favored. And, subsequently, both food and drink should be kept on the truly antiphlogistic scale; so long as there is a wish for adhesion and a probability of its occurrence. Probably, if this dietetic part of the treatment of wounds were more carefully attended to, the occurrence of adhesion would be proportionally more frequent.

At the same time it is to be understood that the principle may be carried too far. Both irritation and prostration of system must be avoided. Only during the first few days is starvation essential, while adhesion is yet probable. That having been attained, a gradual transition is made into more generous regimen. Or, adhesion having failed, a similar transition is equally necessary, after the inflammatory crisis has been passed by. Be it remembered also, that, after severe operations, the antiphlogistic regimen ought always to be conducted with the greatest caution; for it is probable that a tedious cure, by granulation, may eventually tax the powers of the system to the utmost.

A short time is sufficient for the establishment of adhesion. If it is to occur at all, it is certain within a week; three or four days ordinarily suffice. The cut margins are consolidated, the one with the other; the line of wound is dry, and invested by a thin crust. If some of the sutures have not been previously removed, they should now be taken away; their occupation is gone; their presence will but entail suppuration and ulceration in the immediate vicinity of each noose—Nature's invariable effort for extrusion of the foreign substance; and if the inflammation spread, adhesion will be undone, and the wound will gape as at first.

Parts which have been wholly severed from the body—as portions of fingers, of the nose, of the ears, &c.—have been readjusted with success. Under favorable circumstances, reapplication may be made very carefully; retention being secured by suture and plaster, and the treatment conducted for adhesion. But the part is more likely to slough than to live; and, when it does adhere, sensation often returns in a perverted form, causing much uneasiness.

Treatment for Granulation (p. 177).—If adhesion fail, inflammation and suppuration become established. The margins of the wound swell, redden, become painful, and tend to separate from each other; while from the chasm a more or less copious purulent secretion is discharged. Nothing can be worse in surgery, than the retention of sutures under such circumstances. The wound, by swelling, tends to open; but is thwarted by mechanical means. Pus is formed, often copiously, and should be discharged freely; but this, by mechanical and perverse shutting of the wound's mouth, is prevented. The parts are inflamed, and it is our object to moderate the inflammation; knowing well that until that has subsided, the process of healing cannot be begun; but the continued stimulus of the strained sutures maintains and aggravates the untoward process. After a time, the noose ulcerates its own way out, and the part is relieved; but, ere this, much injury by inflammation may have been sustained; and pyæmia, too, is endangered (p. 204). Sometimes, however, sutures are retained for their merely physical effect; though there be no chance of adhesion, and though the suppurating line of wound may be struggling to be free. In the operation for reclaiming simple fungus of the testicle, for example, sutures are so used; otherwise, during the granulating process by which the wound generally heals, at least in part, the fungus would spring upwards, and again project—retarding or even frustrating the cure.

While all sutures, in an inflaming wound, are in general not only useless but injurious, and ought to be removed, the plasters may be allowed to remain. They yield a little, so as to permit the due amount of opening in the wound; yet still they retain an approximating power, and prevent undue resilience of the edges. They are not only left undisturbed, but, when loosened by the discharge, are to be renewed. The secretion is wiped up frequently; but no absorbing dressing is required; pledgets, compresses, and bandages, only heat and irritate the part, and determine inflammation. If anything be applied, light and simple water-dressing is enough; of no greater extent than is sufficient to cover the line of wound. After a time, this dressing is medicated by some gentle stimulant, as zinc (p. 211); and, if need be, bandaging is employed.

There are many wounds, either altogether incapable of adhesion, or in which it is not to be expected. Those, for example, with loss of substance, which cannot be approximated; and those which, from lodgment of foreign matter, or other cause, can scarcely fail to inflame and suppurate. In such, the treatment is precisely similar to that recommended for abscess, after incision (p. 190), and in the management of the simple suppurating ulcer (p. 209). Here, the use of sutures is never expedient—with such exception as has already been stated (p. 560); it is worse than folly to drag and retain parts in contact, which cannot adhere, which must inflame and separate. We never attempt to make the coaptation complete; we would not have it so, were it in our power. The parts are simply replaced, and retained, as nearly as possible, in their natural situation, by careful attention to position. In some cases, a strip or two of plaster may be useful; as when a flap is loose, and threatens to be pendulous. Then the water-dressing is applied; at first cold, to suppress oozing; afterwards tepid, to prove comfortable to the part, and yet not to favor return of bleeding. As inflammation sets in, after some hours, it is gradually made hot, and frequently renewed; in order to moderate the vascular excitement, relax the part, and favor secretion (p. 156). As inflammation subsides—usually in a day or two—the temperature is diminished, until the dressing is simply protective and detergent; to continue a high temperature then, would be to encourage the untoward relaxing and congestive effects formerly spoken of (p. 190). Should the granulating sore begin to evince symptoms of deficient power, the dressing is medicated, stimulantly, in the ordinary way (p. 213).

Uniform support by bandaging, when suitable to the form of the part, is usually expedient, in these cases, from a comparatively early period. It must always, however, be employed with much caution. If pressure be had recourse to unnecessarily, if it be partially and unequally applied, if it be of undue severity, or if its use be unnecessarily prolonged, harm by inflammation cannot fail to ensue—in any wound.

In some cases, the inflammatory process threatens to prove excessive, and may cause gangrene around the wound; thereby untowardly enlarging its extent, and protracting the cure. To avoid this, more active antiphlogistics are sometimes required; abstraction of blood from the part, and, it may be, from the system also; along with other ordinary antiphlogistic means.

Constitutional treatment, so long as the inflammatory stage persists, is antiphlogistic; proportioned in severity to the amount and kind of the affection. Towards the latter part of the cure, when suppuration is profuse, and contraction slow, a generous regimen becomes expedient; and even powerful tonics and stimuli may be required.

Sometimes the case may be so managed, that adhesion is ingrafted on granulation. For example, in deep suppurating wounds (as after amputation), which, by fulness of their edges, admit of complete and easy approximation, water-dressing may be discontinued under certain circumstances, and plasters applied in the same manner as recommended for adhesion. This fortunate period is, when suppurative inflammation has ceased, and when the inflammatory process is merely sufficient for the formation of healthy granulations. At this time, the discharge is in very small quantity; and the divided surfaces are almost as prone to coalesce, firmly and permanently, as in the glazed condition, formerly spoken of, which occurs soon after cessation of the immediate hemorrhage (p. 557). Consequently, when the watchful surgeon seizes upon this opportunity, and, discontinuing his second-intention treatment, places and retains the parts in close and accurate apposition, it is more than probable that cohesion will then take place, speedily and effectually, by amalgamation of the granulating surfaces. If it fail, there is merely the trouble of removing or relaxing the retaining plasters; resuming the treatment by lint and oiled silk.

In the healing of all wounds, whether by the first or second intention, the importance of absolute rest of the injured part is very obvious. Without this, the reparative process must be constantly liable to interruption. It may have been most favorably commenced; Nature may seem most anxious to complete it; and yet all her best-intentioned efforts may be frustrated by negligent permission of movement. Motion of the body is often both requisite and allowable, for maintaining the general health, and may thus contribute somewhat to the cure; but all movement of the part itself is most prejudicial, and must be guarded against by every means in our power. Muscles must be kept relaxed and quiet; joints must be placed in a comfortable and convenient attitude, and retained so. And, to effect this latter object, it may sometimes be necessary to apply splints; so arranged as neither to make undue pressure on any injured part, nor interfere with dressing and inspection of the wound. When this is so situated as to be under the bed-clothes, it is, of course, protected by a suitable cradle from their contact and pressure.

Treatment suitable to the Modelling Process, and to the mode of healing by Growth (p. 176).—The principles of such treatment are very simple; but they are of comparatively limited application. They need be attempted only in wounds of slight extent, and in patients of no inflammatory tendency. In all wounds which can be approximated completely, adhesion is preferable; not as forming a more efficient cicatrix—for in that respect it is inferior, at least to the method by growth—but as less liable to fail, and lapse into suppuration.

The manual part of the treatment mainly consists in protecting the raw surface from atmospheric influence. Nature may effect this, by a crust of her own. And we may imitate this incrustation, in various ways; coagulating the juices on the part by a light application of the nitrate of silver; soaking a piece of lint, little larger than the wound, in the oozing blood, and permitting it to dry and harden on the part; laying on goldbeater's skin; evaporating collodion on a stroma of lint or charpie; overlaying the part with a solution of gutta-percha in chloroform; or employing tepid water-dressing, and renewing it seldom if at all. The collodion forms an admirable thatch; but it has one objection, namely, causing pain and stimulus in application. Instead, I have sometimes used a thick semifluid aqueous solution of gum tragacanth. It is laid gently and uniformly on the raw surface, so as completely to protect it; and if at any portion the envelope threaten to become imperfect, the attendant is directed to effect an immediate repair. The application is productive of no irritation; and, being translucent, permits a complete surveillance of the part. Atmospheric influence is completely excluded; and the raw surface would seem to be placed in circumstances somewhat analogous to its normal state, as if still invested by the integument. Should inflammation ensue, no harm has been done; on the contrary, this is likely to prove less intense than it otherwise would have been; the gum is loosened and washed away by the purulent secretion; and water-dressing may then be used, as in ordinary circumstances.

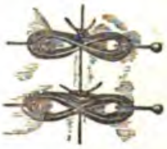
The constitutional treatment is antiphlogistic; rigidly enforced. In short, our object is to avoid all stimulus, both local and constitutional; and thereby to prevent the occurrence of inflammation. A very minor grade of the inflammatory process is what we desire; little if at all exalted above the normal standard.

Exceptions.

Such are the means whereby the different modes of cure may be favored. Nothing is actually done by surgery itself; our art must rest contented with assisting, or at most directing, the workings of Nature. To the general rules there are found exceptions; as might naturally have been expected.

The most prominent of these, is the use of *Twisted suture;* especially suitable to some wounds of the face; as for the cure of harelip. Here the rule of delay, previous to coaptation, is transgressed; and with impunity. Also, the sutures are permitted to remain, until adhesion has been supposed complete. A needle—a common sewing needle, or one made for the purpose with a flat steel point—is made to transfix the margins of the wound; and is retained. Around it a waxed ligature is passed, in the form of the figure 8; and, by this, the wound's margins are brought and retained in contact. Each needle has its own ligature; for if union or community of thread be attempted, puckering of the edges is very likely to follow. In such a wound as that for harelip, two points of this suture usually suffice. At the end of two or three days, one needle is removed; on the day after, the second is also gently loosened and taken away. But the twisted threads—by this time soaked, concrete, and adherent to the integument beneath—are usually left undisturbed.

Fig. 211.

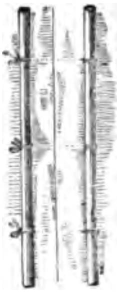


The twisted suture.

Such wounds, whose superficial extent may vary, but whose depth is limited, admit of being retained in close and accurate contact at every point; so as to prevent the interposition of coagulated blood, or other obstacles to adhesion. Accordingly we find, that when they are brought together at once by the twisted suture, neatly and carefully applied, and when the needles are cautiously removed as early as prudence will allow, adhesion scarcely ever fails to occur. But if—in addition to the points of suture—plasters, pledgets, or other dressings be applied, the rule again becomes absolute, that multiplicity of investments are inimical to adhesion; the wound will suppurate at one or more points, or throughout even its whole extent.

In some situations, as about the nose, neither plasters nor the twisted suture can be used as retentive means. Then, as few points as possible of the common interrupted suture are to be inserted; and they should all be cut out, so soon as the progress of adhesion has rendered their retentive influence no longer absolutely necessary.

Fig. 212.

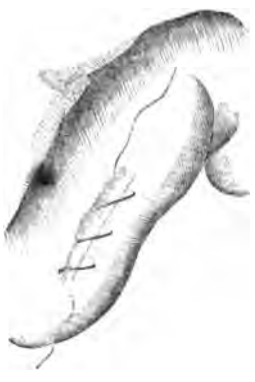


The quilled suture. The dotted lines mark the course of the ligature beneath the integument.

There are certain wounds—as in the vagina, and in the case of lacerated perineum—in regard to which often the *Quilled suture* is the preferable means of retention. And, indeed, in any part, the circumstances of a wound may make recourse to this form of suture expedient. For the whole tract is, in every point, placed and maintained in accurate contact. Ligatures are passed, as in the interrupted suture; but, instead of being secured in the ordinary way, the ends on each side of the wound are tied on a quill or portion of bougie, which is thus made to press the parts into apposition.

The *Continued*, or *Glovers' suture*, is made by a fine needle and thread, as if on a piece of linen. It is seldom employed but in the case of slight wound of intestine.

Fig. 213.



The glovers', or continued suture, in wound of the bowel.

In large wounds, it may sometimes happen that treatment, such as we have recommended, fails in effecting coaptation throughout the whole extent; that the deep walls separate, and that blood or matter tends to accumulate between. In such a case, it will be expedient to employ compress and bandaging, lightly applied, from the first.

Other instances of wound, in which the general rules of treatment must be either varied or transgressed, will occasionally occur in practice; the peculiar circumstances of each will regulate the surgeon as to the treatment to be adopted. But even to them this general rule will be found applicable:—The less their management varies from the principles inculcated in the preceding pages—more particularly the all-important maxim of simplicity—the more likely will it be to prove suitable and efficient.

These principles may be briefly recapitulated as follows:—*In regard to the adhesion of incised wounds;* delay in complete approximation is advisable. Cold water-dressing is applied until bleeding has ceased. Then the wound may be closed; the cut surface having assumed a glazed appearance.

Delay and the cold applications are, besides, useful in preventing secondary hemorrhage. Should this occur, the open state of the wound is favorable to the adoption of means necessary for its arrest.

In effecting approximation, stitches may be employed when necessary; but they should be few, and in all cases their use is temporary. In a great number of instances, they are entirely dispensed with. The principal and permanent retentive means, are the slips of non-irritating isinglass plaster. And, as soon as these have become fixed in their hold, sutures may be removed. The harelip operation, and some other wounds, are exceptions.

The isinglass plaster, being translucent, admits of a constant and complete surveillance of the uniting process in every part of the wound. It does not irritate the surface on which it is applied, is very adhesive, and seldom requires renewal during the cure.

No other dressing is applied. When coaptation has been effected and made permanent, all the manipulation necessary to adhesion is accomplished; dressings additional to the plaster, therefore, can do no good, may do harm, and are to be avoided. Cleanliness of the part, by gentle and occasional wiping—not of the wound, but of its neighborhood—is all that is further requisite.

By this mode of dressing, the occurrence of adhesion is rendered much more probable; the patient is saved much pain and irritation; and the surgeon is freed from no little trouble and annoyance. Should adhesion fail, the parts are in a more favorable state for assuming the other process of union, than they would have been, in similar circumstances, under the old system.

In regard to union by the second intention:—Usually no stitches are employed. Approximation does not require to be complete; and partial coaptation is made by simple replacement, and attention to position.

If intense inflammation follow the injury, active antiphlogistics must be resorted to, according to general principles.

Usually, water-dressing is the only application; unless during the latter part of the cure. At first cool; then gradually increased to antiphlogistic temperature; afterwards tepid and comfortable. When gentle stimulation of the granulating surface is required, towards the end of the cure, water gives way to medicated solutions; proportioned in strength to the exigencies of the case.

Heavy, fetid, cumbrous poultices, and greasy, rancid, irritating ointments, are superseded.

In the last stage of union, both by the first and by the second intention, and especially in the latter, support, with mild and uniform pressure, is not unfrequently advisable. It is effected by plaster, by bandage, or by both.

The process of union by the second intention may sometimes be dexterously *supplanted* by a semblance of adhesion. The period when this can be accomplished is, when the inflammatory process has subsided from the suppurative, to what is simply essential to reproduction. When the new and active granulations are then brought into close contact, they may quickly coalesce; a great part of the uniting process having been effected previous to apposition.

Two common and prominent *exceptions* to the preceding rules are, 1st. When the cut surface is such that every point can be placed in close and accurate contact, without the risk of coagulum or any other obstacle to adhesion being interposed; then, twisted sutures constitute the sole dressing. 2d. When the wound is so situated that neither plasters nor twisted sutures can be applied; then the common interrupted suture must be used—as few in number, and of as short duration, as possible.

The most prominent point, in the simplicity of the modern and improved treatment of wounds, is the employment of water-dressing. It may not be uninteresting briefly to consider this, historically.

Hippocrates used water, cold and hot, as a local application; both in injury and disease. But the simplicity and common sense of the old man of Cos were soon departed from; in favor of the farrago of vulnerary nonsense, invented by his less skilful and more conceited followers.

Paracelsus in his "Great Surgery," 1536, seemed to have a most just perception of things when he exclaimed, "Not without reason do I call Nature the physician of wounds!" And adds—"Warily must the surgeon take heed not to remove or interfere with Nature's balsam, but protect and defend it in its working and virtue. It is the nature of flesh to possess in itself an innate balsam which healeth wounds. Every limb has its own healing in itself; Nature has her own doctor in every limb; wherefore every chirurgeon should know, that it is not he, but Nature, who heals. What do wounds need? Nothing. Inasmuch as the flesh grows from within outwards, and not from without inwards; so the surgery of wound is a mere defensive, to prevent Nature from suffering any accident from without, so that she may proceed unchecked in her operations." Such sound maxims, however, were little, if at all, regarded by the profession; and it has been reserved for our day to see their full adoption.

During the siege of Metz, 1553, a quack, Maitre Doublet, "performed strange cures with simple white linen, and clear water from the fountains and wells; and every one went to him, as if he were Maitre Ambrose Paré himself—a man so celebrated, and considered the first of his day." Ambrose acknowledged the success, and imitated the practice; having at the same time the good sense to see that the real virtue lay in the "clear water," and not "in the mysterious words, and vain and unchristian ceremonies which M. Doublet made to accompany this new and singular practice." These, accordingly, he omitted.

In 1560, Gabriel Fallopius strongly recommended the use of water as a "fruitful source of success." In 1570, Palazzo wrote on the *true* method of curing wounds, by "simple water, hemp, and flax;" the temperature varying according to circumstances. In 1578, Laurent Joubert exposes the folly of charms, and contends that "common water is most efficacious in procuring a favorable termination, and a good cicatrix."

About this period, disputes were rife, whether to incantation or to water the credit of the cure was due; and, at last, the point was decided in favor of the water, by the Chancellor of the University of Montpellier.

In 1732, Lamorier published on "the use of common water in surgery;" contending that there were few wounds which could not be healed by this treatment, more promptly and satisfactorily than by any other means.

In 1785, a number of men, proving cannon at Strasbourg, were wounded by the bursting of the ordnance; and, in their case, the water-dressing proved very successful. A comparative trial was made of "blessed water" and simple water, without any appreciable difference being observed in the effects. Baron Percy, was witness to this; and, becoming enamored of the water-system, employed little or nothing else in the treatment of wounds; protesting, that he "would relinquish military surgery, if he were prohibited from using water"—as a vulnerary.

Larrey, in the Egyptian campaign, used the waters of the Nile, in the treatment of wounds, with much success. Kern, of Vienna, strongly espoused the same cause; as also Breschet, Berard, and other celebrated surgeons. In Ireland, it met with an able and zealous supporter, in a late eminent practitioner; and the name of Mathew is not more associated with the use of the limpid element internally, than is that of Macartney with its external application. In this country, no one labored more successfully and zealously than Liston, in reprobating the "nimia diligentia" of the previous system of vulnerary manipulation; in establishing the claims of the simple water-dressing, both hot and cold; in carrying into practice, and illustrating the truth of the maxims of Paracelsus, on this point—too long neglected; and in thereby conferring a great boon, both on the profession and on mankind.

The Making of Wounds.

On wounds made designedly, for surgical ends, the principles of cure have an important bearing. In the great majority of cases, it is our object that the wound shall heal in the most favorable way—by adhesion. Accordingly, the wound should be planned and made so as most to favor that occurrence. The knife used should have a keen edge, and be worked with little pressure; cutting with a sawing motion, rather than with a thrust; the object being to make a clean and smooth cut, devoid of bruise or laceration. Neither is the cut to be made across the muscular fibres, but in a line parallel with their course; otherwise the wound will gape, and, even with force, approximation of the edges may be uncertain. By following the contrary practice, on the other hand, mere relaxation of the part will often be sufficient for the requisite apposition. When the incisions are made for removal of a diseased or injured part of the body, we endeavor to save as much of the external parts, more especially of the integument, as will admit of easy closure of the chasm. And, when the wound is deep, we make its external part more extensive than the internal; in order that the secretions, which must form to a greater or less extent, may have free exit; so avoiding retention of these, separation of the wound's edges, obstruction of the adhesive process, consequent vascular excitement, and suppuration.

II. CONTUSED AND LACERATED WOUNDS.

These, closely resembling each other in their nature, and in the treatment required, need not be considered separately. They are inflicted by a blunt body, forcibly applied; or by powerful divellent force. In the one case, the margins of the wound are bruised; in the other they are torn, and of a ragged appearance. Such wounds are attended with comparatively little hemorrhage and pain; but they are not the less formidable on that account. The lacerated artery, it will be remembered, accomplishes its own hemostatics, with rapidity and ease (p. 308); and when much bruising or tearing of the breached part, has occurred, there is depression of the nervous as well as of all other vital function, and consequently but little sensation of pain. Were it to be imagined that, because a wound is neither painful nor inclined to bleed, it must be trivial, many and serious errors of diagnosis and prognosis would result.

Adhesion is impossible; inflammation and suppuration are certain. In the greater number of cases, the bruising and tearing are such, as either to kill a portion of the implicated texture outright, or so far to diminish its vital power as to render its speedy demission of life inevitable. That dead part must be thrown off, according to the general law; and, however slight the slough may be, its detachment cannot be effected without inflammation, suppuration, and ulceration (p. 236). In severe cases, there is a double risk connected with the accession of gangrene. Not only will there be loss of substance by the immediate sloughing; entailing much suppuration, risk by hectic, and tedious cure. But, besides, the gangrene may spread; either so as to invade and destroy a large extent of surface—enhancing the dangers just mentioned; or, involving the whole limb, it will throw the system into intense fever with prostration, and demand amputation.

Treatment is twofold in its object; to limit the accidents from inflammation and its results; and to favor granulation in the manner already described. The water-dressing is at first cool; so as to arrest bleeding, and yet not increase the risk from gangrene by still farther depressing the vitality of the parts; afterwards it is hot, and conducted in the usual way. Often a large, soft, simple poultice, frequently renewed, is found very soothing to the part, during the inflammatory stage. In severe cases, much judgment is required, to regulate the antiphlogistic means; and this is more especially necessary in regard to abstraction of blood, from the part and from the system. On the one hand we must be sufficiently active, to check an untoward amount and intensity of inflammation, and so to limit loss of substance and constitutional disorder from extensive gangrene. On the other hand, we must be careful not to lower the system too far; remembering that suppuration, hectic, and it may be typhoid symptoms, are yet to come. Sutures are in no case necessary, and ought not to be applied; sufficiency of apposition is effected by replacement, attention to position, and the adhesive slips, if need be. During separation of the sloughs, hemorrhage may occur; the process, therefore, has to be watched anxiously. Should abscess form in the neighborhood of the wound, or diffuse purulent infiltration threaten, free incision should be practised early.

It is to be remembered, however, that all wounds inflicted by a blunt instrument are not necessarily of this second class. In some cases, they belong rather to the first; and require the same treatment. When an obtuse body, as a stick, stone, or bar of iron, is brought with smart violence in contact with integument placed over a resisting bone (as on the cranium), an apparently incised wound is not unfrequently the result; the same in appearance and general character, as if inflicted leisurely by a knife. No doubt, the parts must be to a certain extent bruised; yet the bruise is not shown at the time, and may never be evinced at all,—healing taking place readily enough by the first intention. The wound is partly incised, partly contused; but it partakes much more of the former than of the latter character; and is to be treated accordingly—by close apposition, and with a view to adhesion.

III. PUNCTURED WOUNDS.

These are inflicted by the penetration of a sharp and pointed instrument, which bruises and tears as well as cuts. This class of wound, consequently, is of a compound nature. When of any considerable extent, the injury is always serious. A long track of superficial wound, involving little more than the integument and areolar tissue, is comparatively trivial; when, however, the direction is not along the surface, but towards the interior, there is always reason for apprehension. The danger is twofold:—First, from injury done to important parts; as arteries, veins, nerves, canals, cavities, joints. Secondly, from inflammation occurring in the deep part of the wound, the purulent secretion being confined, diffuse infiltration being consequently favored, and much damage resulting to both part and system. The form of the wound renders the former danger probable. Its nature disposes to the latter; for, being in part both contused and lacerated, a certain amount of inflammation is but too certain; especially in those cases in which blood has been infiltrated into the areolar tissue, in consequence of the form of the wound preventing its free exit. A third danger may be stated; from the chance of a part of the weapon breaking off, and remaining lodged in the depths of the wound; rendering inflammation there, and that of an intense character, inevitable.

Treatment.—At one time it was the invariable custom of the surgeon, so soon as satisfied that a wound was of the punctured kind, to dilate it freely; so as to give it an undoubted title to the appellation of incised. And it was thought that the patient was really benefited by such procedure. Such wanton cruelty, however, has now been justly abandoned. Dilatation may be required; but often it is neither necessary nor expedient in the first instance. The greater number of punctured wounds partake of the incised character, more largely than of the bruised and lacerated; and are to be treated accordingly. By inquiry into the history of the case, examination of the inflicting weapon, and the gentlest possible probing, if need be, it is ascertained that no foreign matter lodges in the wound. Apposition is then effected, gently and accurately; by attention to position, and use of the isinglass plaster. The part is kept at rest; and the system is placed under the antiphlogistic regimen. We look for adhesion, and frequently are not disappointed. Yet it is not unlikely to fail, for the reasons already stated. When it does, transition is made to warm water-dressing, and other means suitable for mitigating the coming inflammation. If this prove moderate, the discharge have free exit, and no swelling or hardness form deeply, there is yet no demand for dilatation. The ordinary treatment of granulation is carried out; and, by granulation, the aperture in due time closes.

Dilatation, however, may be most necessary under certain circumstances. 1. Hemorrhage may be serious, from a divided or punctured artery; and pressure either may have failed, or may seem unsuitable. In the original state of the wound, deligation is impracticable; yet the ligature must be applied. By incision, accordingly, the bleeding point is to be exposed; so as to admit of deligation being easily and securely performed. 2. A portion of the weapon, which inflicted the wound, may remain firmly imbedded in the deepest part. It may be necessary to dilate, to a certain extent, so as to permit the application of forceps, or other instruments, for extraction. 3. When, by deeply seated inflammation, and purulent confined secretion, diffuse infiltration is threatened (as indicated by deep pain and hardness, swelling of the whole wound, redness of the integuments, and violent constitutional disturbance), free incision cannot be too early employed. Then dilatation is essential to save structure, and to moderate serious disorder of system. When fascia, or other tendinous texture, has been involved in inflammation and infiltration, the case proves peculiarly troublesome, as can readily be imagined, and demands great energy of local treatment. The knife must be used freely (p. 202).

IV. POISONED WOUNDS.

By the experiments of Blake and others, it seems fully established that virus pervades the system through the blood; thence reacting injuriously on the nervous system, and interfering more or less with all the functions of life. The effects are never instantaneous. A certain number of seconds (not less than nine) are requisite for absorption, even of the most deadly poisons. Some of the more intense, as that of the most venomous serpents, would seem also to have a direct influence on the nervous centres; probably by contact of the poison with the nerves of the part injured. Certain it is, that the nearer the wounded part is to the brain, the more speedily are the untoward symptoms developed. But, even admitting that this direct nervous implication is true, it can only obtain to a comparatively slight extent; and we are still forced to hold that the main agent of diffusion through the system is the circulating blood. For it seems established, at least in the majority of cases, that the contact of poison with the surface of the body is not sufficient to give rise to general symptoms; so long as its general diffusion throughout the body, by the circulation, is prevented. It does not follow that the virus, when so diffused, shall affect all parts, in their functions, to an equal degree. On the contrary, it is found that certain tissues suffer in an especial manner; the nervous, pre-eminently.

When virus has been introduced into the system, and is not speedily thereafter extruded by elimination, it is supposed that a process takes place in the blood, somewhat analogous to fermentation, and hence termed *Zymosis;* whereby the whole circulating fluid is deteriorated, and the poison at the same time multiplied, perhaps to a great extent. And according to the poison, this process varies much, as to the time which is requisite for its completion.

Some poisons, of much virulence, produce their deleterious, and perhaps fatal effects, very speedily—so soon as introduced by the blood into the system; as happens in the bites of the most venomous snakes. Others, again, do not exhibit their results, until the process of zymosis has been tardily completed; as in hydrophobia.

A third class of poisons—the venereal, for example—seem to have a doubly zymotic character. At first, the part is inoculated; and there the poison accumulates, by zymosis; forming the characteristic pustule and sore. Thence the system becomes contaminated, through absorption; and in the blood a second, or general zymotic process is effected, whence the secondary symptoms are produced.

The local effect of inoculated poisons is to produce intense asthenic inflammation in the injured parts; running rapidly on to diffuse infiltration of most unhealthy pus, spreading fast and far, accompanied with much swelling and livid discoloration, and often ending soon in gangrene. Often there is a further complication by inflammation of lymphatics and veins. And, altogether, a state of matters is established which was formerly not inaptly termed *Cellulitis Venenata.* Gangrene having ceased, and sloughs separated, a deep, troublesome, unhealthy sore remains.

Poisoned Wounds by Dissection.

Here the deleterious virus may be animal; engendered in the body previous to death, and as yet not altered by decomposition; as putrefaction advances, its virulence seems to be destroyed. This form is encountered in the dissection of females who have died from puerperal disease, for example; and inoculation with such a poison is a very formidable accident. Or the virus is the result of ordinary putrescence; and the inoculation of this is an infinitely more common occurrence. The injurious consequences are manifested, both in the part, and in the system.

I. LOCAL.—These, again, are either simple or severe. 1. *Simple.*—A part is punctured, usually the finger; by a scalpel, needle, or projection of bone. The more ragged the puncture, and the less the bleeding therefrom, the more likely is the virus to lay hold of the part and be absorbed. After some hours, inflammation takes place, and a pustule forms at or near the puncture. The pustule gives way, discharging a thin, unhealthy, puriform fluid, and degenerates into an acute and painful ulcer. A minor amount of the inflammatory process involves the integuments around, which are red, hot, and painful, and slightly swollen; and, not unfrequently, this, spreading, establishes an erythema or simple erysipelas. This is the most common form of accident; of almost everyday occurrence in the dissecting room.

Sometimes a violent form of deep whitlow is induced; requiring incision, to prevent disorganization of texture. Sometimes secondary abscess collects in the axilla; of a chronic kind, without apparent affection of the intervening lymphatics. Sometimes no acute affection occurs at the site of injury; but chronic induration forms, and is of long endurance.

2. *Severe.*—The inflammatory process is diffuse from the first, and pustular formation at the injured part may or may not occur. A genuine erysipelas is established. And, not unfrequently, angeioleucitis plainly coexists; evinced by red streaks, very painful, stretching continuously up the arm from the erysipelatous part; or by acute glandular enlargement in the axilla, connected with isolated patches of inflaming lymphatics on the inside of the limb. Abscess usually forms in the glands, very speedily; perhaps accompanied with purulent infiltration of the surrounding areolar tissue. The latter casualty often occurs, also, in the areolar tissue on the corresponding side of the chest. Sometimes the first symptom which attracts the patient's attention, is an intense pain in the shoulder; soon followed by glandular enlargement in the axilla, while yet the changes at the injured part are comparatively unimportant. When such is the case, diffuse areolar infiltration of the corresponding side is seldom absent, and usually extensive. And such local disasters, it can readily be understood, are invariably accompanied with intense constitutional disturbance.

II. GENERAL.—1. Derangement of the general health, without local injury, is not unfrequent; the poison entering the system by the skin or by the lungs. This deleterious matter would seem also to be of two kinds; generated in the body before death, as in fever, and encountered in subjects recently dead; or the gaseous product of ordinary putrescence, emitted by any body much decomposed. From either form the student seldom suffers, unless he be either very much exposed to the contagion, by long and habitual stay in the dissecting room, or predisposed in consequence of previous disorder of the system. He feels feverish, languid, listless, and without appetite; the bowels become irregular, and diarrhœa sets in, accompanied with much flatulence; the gaseous product of the stomach and intestines is very fetid, the fetor closely resembling that of the dead body whence the deleterious influence has proceeded; and the same odour is also usually perceived in the mouth, in the breath, in the exhalations from the skin, and in the urine. The system seems saturated with the poison, and busy in freeing itself by elimination. After diarrhœa has continued for some time, perhaps accompanied with profuse perspiration at night, the symptoms usually abate; the greater part of the deleterious matter has been extruded, and the system rallies; unless the same cause be still in operation, through imprudent continuance in the dissecting room.

2. Constitutional symptoms of the gravest kind attend on the severe local affection; sometimes antecedent, sometimes consequent; most frequently the former, and becoming aggravated as the local affection is developed. At first, there is febrile disturbance of a simple kind. As the local changes form, the fever assumes the inflammatory type; but that usually is of short duration; and is merged in constitutional irritation of a very low kind, tending urgently towards typhoid prostration. In the minor local affection—pustule and erythema—the febrile disturbance is but slight and simple. But in the more severe form—consisting of angeioleucitis, glandular abscess, and diffuse areolar infiltration, often complicated by erysipelas, and perhaps with inflammation of the veins—the general symptoms are from the first of a most alarming nature, and place life in the most imminent peril. In some few cases, the precursory fever has been so intense, and yet of so low a type, as to carry off the patient even before full development of the local disorder; as if by direct poisoning.

Treatment. 1. *For the local symptoms.*—Prevention is in our power, and ought never to be neglected. A wound, scratch, or puncture, however slight, having been received, the part should be immediately washed, and well sucked by the mouth; which latter operation has the doubly beneficial effect, of both taking away virus, and preventing absorption of any small quantity which may for a time lurk in the part. At the same time, enlargement of the wound may be expedient. If it have been inflicted by the scalpel, and already show an inclination to bleed (increased by suction), it need not be interfered with. But if it be a ragged scratch or puncture, from a pointed and edgeless substance, as a spiculum of bone, it is well to dilate it slightly by the point of a clean lancet or scalpel; so as to encourage flow of blood, and thereby favoring the washing away of deleterious matter. After by washing, suction, and bleeding, a sufficient cleansing has been effected, the part should be touched lightly with the nitrate of silver; with two objects in view. The nitrate is supposed capable of effecting decomposition of any virus which may remain imbedded in the wounded part; and we know that it is most efficient in forming a protective crust, whereby the imbibition of other virus may be prevented. To fulfil more completely the latter indication, however, a piece of plaster—or collodion—is laid over the part; and the whole is surrounded by some other envelope. Then dissection may be continued in security.

But a more important means of prevention exists, in regard to both the local and general symptoms; namely, attention to the general health. The robust student is seldom found to suffer; however many may be his dissection wounds, and however careless he may be of their local management. The stomach and bowels should be kept in a healthy state; diet should be generous, yet temperate; a sufficiency of out-of-door exercise should be taken daily; clothing should be warm, and a clean perspirable state of the skin maintained; above all, late hours, and every dissipation, should be most carefully avoided.

Precautionary measures will of course be most attended to, under circumstances of especial danger; as when the body is recent, and death has proceeded from puerperal disease; particularly from affection of the serous membranes; and when the dissector is, from any cause, in indifferent health, and thereby predisposed to suffer.

When local symptoms have become established, the treatment is according to general principles. The pustule is opened, and covered by a poultice, or by warm water-dressing; the part is diligently fomented; and if angeioleucitis be threatened, the application of a warm and weak solution of the acetate of lead, with opium, will be found grateful. If erysipelas occur, or erythema prove troublesome, punctures by the lancet, with the view of local depletion, will be expedient. If erythema be but slight, light application of the nitrate of silver will suffice. When abscess has formed, or when diffuse infiltration threatens, free incision cannot be too early practised at the affected parts; in the latter case, it is only by incisions, almost deserving the term heroic, that disaster can be averted. The wounds are treated by water-dressing; and, at an early period, uniform and moderate support by bandaging should be afforded.

2. *For the general symptoms.*—In the first form—general derangement without local affection, and independent of wound—application of the cause is plainly to be discontinued; that is, the dissecting room is to be left for a time, and the free open air enjoyed, as much as circumstances will permit. Also, the natural efforts towards extrusion of the deleterious matter are to be duly seconded; by purging, diaphoretics, and diuretics; but especially by the two first. There is a natural tendency to both diarrhœa and sweating; and by suitable means, these are to be regulated and maintained; until elimination seem to have been complete. Afterwards, a tonic system of treatment is to be enjoined; more especially generous diet, and exercise in the open country air. Town-life, study, and dissection, need not be resumed, until convalescence is fully established. Usually, no long period of absence is required.

The constitutional symptoms of the second kind—those which attend on puncture, and the local accidents which result therefrom—are not so easily overcome. On their first accession, elimination is still to be attempted; by purging, full emesis, and diaphoresis; and these measures, at the same time, tend to moderate the febrile symptoms. During the short sthenic or inflammatory stage, gentle antiphlogistics are expedient; but general bloodletting, or other heroics, are seldom if ever warrantable. In the more urgent cases, calomel and opium, given so as to lay hold of the system, are sometimes beneficial. When suppuration has been fairly established, and especially if it be of the diffuse character, support, tonics, and stimuli, in their turn, are required; as in other examples of extreme constitutional irritation (p. 81).

The more urgent cases are not unlikely to prove fatal. And those patients who escape with life, often retain but a shattered system ever after. They are liable to chronic suppurations, ulcers, and glandular enlargements; and to many other chronic disorders, of which debility is the prevailing type.

Affections of both part and system, in many respects resembling those arising from dissection wounds, not unfrequently occur in nurses or others who tend unwholesome sores, or who are employed in the washing of foul linen. Similar treatment is required.

Poisoned Wounds by Healthy Animals.

The Stings of Insects may be formidable by their number, by the susceptibility and state of system of the person injured, and by the nature of the part affected. Poison introduced by the stings of a horde of bees may be sufficient to overcome even the strongest individual; but such an intense and concentrated form of the mischief is of rare occurrence. A less amount of injury done to a young child, to a nervous and delicate female, or to any one of temporarily reduced power, may be equally alarming in its effects. The sting of a solitary bee or wasp, in the fauces, as has sometimes happened to the incautious eaters of fruit, is likely to produce such an amount of acute swelling, as to threaten rapid asphyxia. But, ordinarily, the stings of insects in this country are neither many nor serious.

In the first place, the part or parts should be carefully examined by means of a lens; and if the stings are found inserted, they should be carefully removed by finely pointed forceps. Liquor potassæ is supposed to have the effect of neutralizing the virus; the wound, consequently, may be wetted with this. Then, perhaps the best application, both in theory and practice, is the continuous use of cold; a remedy simple, effectual, and always within our reach. Constitutionally, restoratives may be required, at first, to remove the shock under which the patient may be found laboring; partly, from fright; partly physical, from introduction of the virus. Afterwards, calmatives to the nervous system, and gentle antiphlogistics, may be expedient; to subdue slight febrile excitement. In the formidable case of injury to the fauces—threatening asphyxia by rapid mucous swelling—scarification of the part, fomentation outside and in, and the due amount of antiphlogistics, are required; employed actively. And should such means fail, tracheotomy ought to be unhesitatingly performed.

The Bites of Serpents, in hot climates, are extremely formidable. In this country they are comparatively trivial; man having no worse enemy, in this class, than the common viper; whose venom is sufficiently powerful to kill the smaller animals, but is fortunately almost inoperative upon the human subject.[1] A person bitten is apt to be much alarmed; and requires restoratives and reassurance, accordingly. The part swells, and becomes painful and red; undergoing a certain amount of the inflammatory process, but seldom attaining to true inflammation. The ordinary applications are expedient; continuous cold, in the first instance, to moderate and arrest the process, if possible; failing which, fomentation, and the other antiphlogistics. The virus is of so weak and impotent a character, as regards man, that precaution need hardly be taken against absorption. The constitutional effects are slight, if any; the local may be accounted for, almost, by the mechanical injury alone.

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[1] "Insects are the curse of tropical climates. The bête rouge lays the foundation of a tremendous ulcer. In a moment you are covered with ticks. Chigoes bury themselves in your flesh, and hatch a large colony of young chigoes in a few hours (p. 355). They will not live together; but every chigoe sets up a separate ulcer, and has his own private portion of pus. Flies get entry into your mouth, into your eyes, into your nose; you eat flies, drink flies, and breathe flies. Lizards, cockroaches, and snakes get into the bed; ants eat up the books; scorpions sting you on the foot. Everything bites, stings, or bruises. Every second of your existence you are wounded by some piece of animal life that nobody has ever seen before, except Swammerdam and Meriam. An insect with eleven legs is swimming in your tea-cup; a nondescript with nine wings is struggling in the small beer, or a caterpillar with several dozen eyes in his belly is hastening over the bread and butter! All nature is alive; and seems to be getting all her entomological hosts to eat you up, as you are standing out of your coat, waistcoat, and breeches. Such are the tropics! All this reconciles us to our dews, fogs, vapors, and drizzle; to our apothecaries rushing about with gargles and tinctures; to our old British constitutional coughs, sore throats, and swelled faces."—*Sid. Smith's Works*, vol. ii, p. 147.

Though such be the general character of the results of such injuries, yet it is well to remember that, in susceptible frames, the bites and stings of even the least poisonous creatures are not unfrequently followed by very troublesome consequences; angeioleucitis, abscess, perhaps eruption, and febrile disturbance.

Abroad, the accidents assume quite a different complexion. The bite of the rattlesnake in America, and of the Cobra da Capello in India, is often followed by rapid dissolution.[1] The poison acting on the nervous centres, through the blood, as formerly explained (p. 570), may speedily arrest their functions; and the patient dies of vital prostration. Or, reaction having taken place, the disordered state of the blood induces febrile disturbance of a low kind, aggravated by the local changes which meanwhile have occurred in the bitten part; and under this the patient may sink, at a more remote period.

Fig. 214.

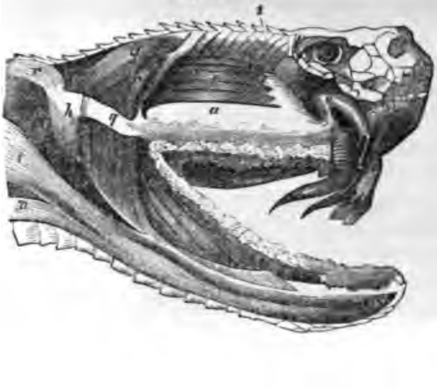

Fig. 215.

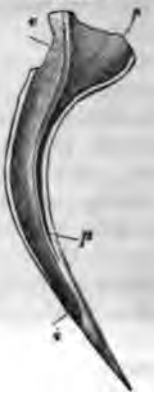

Fig. 214. Head of the rattlesnake. From Cyclop. of Anat. and Physiology. *a a*, Poison gland, and its excretory duct; the latter cut open at its extremity: *e*, anterior temporal muscle; *f*, posterior temporal muscle; *g*, digastricus; *h*, external pterygoid; *i*, middle temporal; *q*, articulo-maxillary ligament, which joins the aponeurotic capsule of the poison gland; *r*, the cervical angular muscle; *t*, vertebro-mandibular muscle; *u*, costo-mandibular muscle. Fig. 215. Poison fang magnified. From the same. *p p*, The pulp cavity of the tooth; *v v*, the canal along which the venom flows, truly on the outside of the tooth.

The local affection is in itself formidable. By the absorption of virus into the blood, and its subsequent diffusion through the system, vital power is lowered generally. By imbibition of the poison in the part injured, the same result takes place locally. Under the stimulus of the injury, the part inflames; and the process, advancing uncontrolled, in consequence of deficiency both in general and in local vital power, soon attains its worst results—gangrene, attended with diffuse infiltration of a putrid sanies. This, occurring in an otherwise sound patient, would of itself induce constitutional disturbance of an alarming kind; but when the additional source of irritation affects a system already brought low by the constitutional and almost immediate result of the injury, it can readily be understood that the most dangerous consequences are likely to ensue.

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[1] "Snakes are certainly an annoyance; but the snake, though high-spirited, is not quarrelsome; he considers his fangs to be given for defence, and not for annoyance; and never inflicts a wound but to defend existence. If you tread upon him, he puts you to death for your clumsiness, merely because he does not understand what your clumsiness means; and certainly a snake, who feels fourteen or fifteen stone stamping upon his tail, has little time for reflection, and may be allowed to be poisonous and peevish."—*Ibid*. p. 140.

Under such circumstances, the required activity of treatment is great, proportioned to the urgency of the case. The first and main indications are—to prevent absorption of the virus, and to obtain its expulsion from the part. With this view, a ligature is to be thrown instantly round the limb, between the heart and the bitten part; so as to obstruct return of venous blood from the latter. Thus time is afforded for fulfilment of the second part of the indication; expulsion of the virus.[1] If the part be favorably situated, free excision should be instantly practised. If that be impracticable, free incision should be made, and the flow of blood encouraged by every means in our power. Suction by the mouth is beneficial after either excision or incision; with the view of both preventing absorption, and favoring the flow of blood, whereby the virus may be washed away. And, provided there is no breach of surface in the mucous membrane, this may be had recourse to with perfect safety to the operator; experience having shown that such virus does not act except on a wound or sore. But the application of a cupping-glass is at least equally efficient, and usually more convenient. It should be retained not only during tendency to bleed, with the view of encouraging escape of blood and all other fluids from the part—but for hours afterwards; experiment having clearly proved that, during its application, absorption takes place very slowly and imperfectly, if at all. Afterwards, it is well to apply the nitrate of silver freely to the part; for the same reasons as in the treatment of dissection wounds (p. 573). When diffuse infiltration has begun—as it speedily will, if we have failed in timely and effectual expulsion of the virus—free incision is required; in order to arrest progress, save texture, and mitigate the general symptoms which would otherwise ensue.

The general treatment consists in the use of restoratives and stimuli, in the first instance; in order to avert death by the immediate effects of the poison, and afford an opportunity for baffling its secondary results also. Ammonia and arsenic are both high in repute, having been well spoken of by experience; the former proving useful, probably, as a powerful and suitable stimulus; the latter, perhaps, possessing some virtue as an antidote to the pernicious virus. The arsenic is given in large doses, and with impunity—one grain of the arsenious acid, or two drachms of the liquor arsenicalis; a tolerance of the remedy being plainly engendered. Its use is continued until free purging is induced. Thus it may also prove of service by elimination; and this may be farther contributed to by emetics and diaphoretics, according as the rallied system will bear. Sometimes vomiting is spontaneous and excessive, tending to accelerate exhaustion of the patient; under such circumstances, it is to be moderated by opium, and the application of sinapisms to the epigastrium. Sinapisms along the spine, too, are useful, by rousing nervous energy. The principal danger having been overcome, tonics, change of air, and generous diet are indicated; to remove the remaining debility.

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[1] The snake charmer in India is provided with very effectual means for safety. The assistant carries small cauteries, in shape and size corresponding exactly to the fangs of the creatures with whom the performer plays; and in the event of a bite, the cautery, heated in a chauffer also carried for the purpose, is instantly inserted into the wound.—Lancet, No. 1530, p. 694.

Many cases, as can be readily understood, prove fatal ere assistance can be obtained. Others are seen too late for employment of the means suited to the prevention of absorption. In such, attention is directed to the constitutional treatment—in order to obtain time for, and to assist in elimination—and to local management, by incision and otherwise, so as to limit the inflammatory accidents in the part.

Poisoned Wounds by Diseased Animals.

The most prominent of these is the fearful malady which occasionally results from the bite of a rabid animal, and is termed *Hydrophobia.*

Rabies in the Dog.—This disease is said to be of two forms. "The *first* is characterized by augmented activity of the sensorial and locomotive functions, continued and peculiar barking, and a strong disposition to bite. The affection commences with some alteration in the peculiar habits and disposition of the animal, who, as the case may be, is more irritable, more tractable, more lively, or more sluggish than usual; or these several conditions may alternate in one and the same animal. An early symptom consists in an inclination to lick, or carry in the mouth, various inedible substances, especially such as are cold. The animal after a time gets restless; snaps in the air, as if at flies, frequently leaves the house, but soon returns; and is obedient and seems attached to his master. According to Blaine, constipation constantly exists. There is usually complete loss of appetite; but the animal seems to suffer from thirst, drinking eagerly, until, as indeed usually occurs, the mouth and tongue become swollen. The eyes are red, and become dull, haggard, and half closed, the skin of the forehead being also wrinkled, which gives the animal a peculiar aspect. The nose, tongue, and throat, now usually become swollen; and the coat becomes rough and staring. According to Hertwig, the mouth is generally very dry; but Blaine has constantly observed a flow of thin saliva. After some time, the gait becomes unsteady and staggering, and finally the extremities are paralyzed. The tail, in this form of the disease, is not drawn between the legs; and the head is carried erect; the nose being pointed upwards. A disposition to bite, sooner or later, invariably occurs; it is not, however, permanent, but recurs periodically; is directed against both inanimate and animate objects; most especially against the cat, less so towards other animals, and least of all towards man. When the animal bites, he does not previously bark or fly at the object of his attack, but approaches in a quiet or even friendly manner, and makes a sudden snap.

"The *second* form of the disease is distinguished by inactivity and depression; there is no disposition to bite—probably from the lower jaw being paralyzed; nor is there any inclination for change of place manifested. The first symptoms are unusual quietness, and apparent depression of spirits. The voice is peculiarly altered, as it is also in the foregoing variety, but there is much less disposition to bark. The mouth is open, the lower jaw hangs as if paralyzed, and is raised only under the influence of strong excitement; there is a constant flow of slaver from the mouth. The animal either does not drink at all, or does so with difficulty; but manifests no fear of water, and, on the contrary, willingly immerses the nose in that fluid. The tongue is almost constantly protruded from the mouth."[1] The animal rarely survives beyond the sixth day. Thus we see that dread of water, and insanity of the dog, are but vulgar errors, in connection with this disease; some animals, indeed, trained to certain duties—as pointers—have performed these while in the rabid state, quite as efficiently as when unaffected. The most invariable symptom is the rough harsh bark; very peculiar, and quite characteristic.

Hydrophobia.—The saliva of a dog, laboring under such a disease, doubtless contains a virus, the introduction of which by inoculation is capable of producing Hydrophobia in the human subject; a disease so termed, not because there is truly a dread of water, but because, in man, the most prominent symptom is inability to swallow, and unwillingness to attempt to swallow any fluid whatever. Two points in regard to the virus of Rabies are peculiar. First, a long period of latency exists; symptoms of the disease, in man, seldom showing themselves sooner than the fortieth day after inoculation. Matured zymosis seems to be essential to production of the full influence of the poison (p. 571). And it may be that a double zymosis takes place, as in the case of venereal virus; first in the part, and afterwards in the system. Second, inoculation is not invariably followed by the untoward symptoms. A number of people having been bitten by the same animal, a few only—sometimes but one, sometimes none at all—fall victims to hydrophobia. The average is supposed to be one in twenty.

The virus of rabies is understood to be originally produced—but how, is yet uncertain—in the dog, fox, wolf, jackall, cat, and badger; and from them to be communicable by inoculation to many others. But it still remains an open question, whether or not these in their turn are capable of reproducing the disease; although the preponderance of evidence and belief, no doubt, leans toward the affirmative.

The most dangerous mode of injury is by bite, on a part unprotected; as the hand or face. A bite through clothes is less formidable; inasmuch as it is probable that the greater part of the virulent saliva has been entangled in the exterior of the cloth, and does not reach the wound. But on the other hand, a bite is not essential. There may have previously existed a scratch, sore, or open surface of any kind, and, from the licking of this by a rabid animal, inoculation will be at least equally certain. The virus is inert on sound skin; as well as when taken internally, without breach of surface in the mucous passages.

Some authorities have been bold enough to deny, that hydrophobia ever occurs in the human subject; believing that what we term such is a simulation, of a nervous character, induced by dread and alarm. But this fancy is sufficiently disproved by the fact, that children have been victims of the disease; as well as adults, who, from ignorance of the very existence of any such malady, could not have been amenable to the mental influence supposed. There is no doubt, that by anxiety of mind a nervous simulation may be induced, especially in females of hysterical tendency; but this can readily be distinguished from the real disease, and is of an altogether different character as to its result; seldom, if ever, proving fatal. Further, the mind apparently has the power of not only hastening accession of the true disease, but also of causing its aggravation.

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[1] British and Foreign Medical Review, No. 25, p. 50.

The period of incubation—that is, the period between the bite and accession of the direful symptoms—is, in man, invariably long; as already stated. Its average may be said to range between five and ten weeks. According to some, even years may elapse. But a fallacy must surely have existed in such cases; an intercurrent injury having doubtless been inflicted, though of so slight a nature as to have failed to attract attention. The symptoms of the disease are generally divided into two kinds; the premonitory and actual.

1. The wound usually heals up in the ordinary way; generally by granulation. But, after a time, pain and itching are felt in the cicatrix, and its neighborhood. The pain increases, and extends up the limb, usually in the course of the nerves; unaccompanied by discoloration of the integument, except at the cicatrix, and not increased by pressure or motion; it is neuralgic. The cicatrix becomes swollen and discolored, and usually ulcerates, discharging a thin unhealthy pus. The general system shows disorder of a febrile character; and marked headache supervenes; with restlessness, disturbed dreamy sleep, increase of shooting pains from the injured part, flying pains in other parts of the body, and other evident signs of much excitement of the whole nervous system. There is great acuteness of the senses, and of the intellectual functions; memory is strong, imagination vivid and fertile, the countenance animated; the eyes sparkling and clear, but intolerant of light. This state, however, is apt to be succeeded by dull despondency; the result, probably, of mental depression and fear. The pulse is usually more frequent and strong than in health; and yet not of the true inflammatory character. Then comes the dread of fluids; completing the first stage; the duration of which is short, never exceeding six days, and usually limited within two or three. In some cases, the premonitory class of symptoms do not occur, or at least are marked most imperfectly.

2. The second stage commences with a dread of fluids. Frightful agitation—accompanied with painful spasm of all the muscles of respiration, especially in the neck, and convulsive difficulty of breathing—is produced by even the sight of liquids; by hearing fluids in motion, or poured from one vessel to another; by the sudden contact of even a breath of cold air; and by the idea of drinking. The patient, usually, is well aware of his state; and, racked with a burning thirst, may try to overcome this instinctive aversion. Summoning a tremendous courage, he may make a dash at fluid, and obtain a mouthful; but convulsions are sure to

follow, most likely preventing deglutition of more than a few drops. Sleep is now lost entirely; and the mind is strangely altered. Despair has taken firm root; the patient considering his doom inevitable, and wishing to be relieved by death from his intense suffering; yet often talking with volubility and assumed ease, on subjects indifferent or trifling, in the vain attempt to conceal his real condition. Sometimes, anxiety is obscured by no attempted concealment; and occasional screams attest the horror and suffering. The general surface is extremely irritable; the slightest impression on it exciting the paroxysms. And these are also produced, not only by the sight, hearing, and thought of fluids; but also by the sight or hearing of objects connected therewith, as cups, teaspoons, &c. This hydrophobia may remit for a time; in some few cases, an intermission has occurred, and swallowing of drink has been accomplished with comparative ease; but the amendment is deceptive; and the paroxysms recur in a more intense and enduring form. There is pain in the neck and throat; and pain in the epigastric and diaphragmatic regions; often occasional vomiting of dark, bilious matter. A thick tenacious sputum accumulates in the mouth and throat; occasionally it is seen frothy on the lips, in consequence of the difficult respiration; and the attempts to dislodge it, by hawking and expectoration, are very frequent and distressing. The voice is changed, and hoarse; but it requires fancy to assimilate it to the barking of a dog. Occasionally, a croupy noise is made in inspiration, during spasmodic contraction of the glottis. Sometimes there is an inclination to bite; not, usually, from savage inclination; but involuntarily and unwittingly; the patient often taking care to forewarn his attendants.

As the disease advances, cerebral excitement and disorder become more and more apparent. The eyes are staring, bloodshot, and never shut; hearing, sight, and touch, are wonderfully acute, but deceptive; speech is abrupt and rapid, and now incoherent; and at length delirium is confirmed. The paroxysms of difficult breathing, with spasm of the muscles of the throat, become more and more marked; in one of these the patient dies asphyxiated; or he sinks, exhausted, during a period of remission. And such is the second stage; usually of even shorter duration than the first. Sometimes, death is immediately preceded by complete remission of all the symptoms.

The morbid appearances, usually observed, are congestion, with serous effusion, in the brain and spinal cord, and in their membranes. The mucus membrane of the stomach and fauces is highly increased in vascularity; that lining the air-passages is often in a similar state, and the lungs are much congested. The whole blood is dark and grumous.

Tetanus is the disease with which this is most apt to be confounded; yet the differences are sufficiently marked. The spasm of the muscles is more continued in tetanus; less remitting, and never intermitting. The jaw is usually much in motion in hydrophobia, in frequent attempts to clear the mouth and throat from the peculiar tenacious mucus; in tetanus it is fixed. Tetanus is rarely attended with aversion to liquids; on the contrary, the bath is grateful; nor are the tetanic paroxysms increased by the sight, hearing, or touch of fluids. Also, tetanus makes its accession usually at a much earlier period, after infliction of the injury.

Physiologically, while tetanus is a disease of the true spinal system, hydrophobia involves the brain also; as evinced by the disorder of intellectual function and special sense, even early in the disease. While, in tetanus, the stimulus which excites the paroxysms "operates through the true spinal cord: in hydrophobia it is often conducted from the ganglia of special sense, or even from the brain; so that the sight or sound of fluids, or even the idea of them, occasions, equally with their contact, or with that of a current of air, the most distressing convulsions."[1] Further, the two diseases differ greatly in their mode of induction. Tetanus is caused by irritation of a nerve in the traumatic cases; by disease of the spinal marrow, in those which are idiopathic. Hydrophobia is the result of a specific poison introduced into the circulation, and thence affecting the nervous system.

The characteristics of the hydrophobic symptoms may be briefly stated as follows:—They are paroxysmal; having marked remissions, and occasionally intermitting. Breathing and deglutition are the functions most prominently affected, by spasm of the muscles therewith connected. The external surface is extremely irritable. The intellectual functions are perverted; often from the first; but not truly deranged till near the close. The paroxysms are excitable by sight, hearing, touch, and mental function. The blood, deteriorated by the virus of rabies, injuriously affects the nervous centres; increasing their excitability to such an extent, that the slightest causes are sufficient to induce the most violent spasmodic actions.

Treatment.—The principal duty of the surgeon consists in adopting means for *prevention;* those of *cure* are but little within the reach of either science or art, however skilful. A person bitten under suspicious circumstances is usually much alarmed, and applies for relief without delay. Our first business is to inquire into the history of the accident; the disposition of the dog; its apparent condition at the time; whether loose or chained, whether provoked or not. For it may happen that the animal was not to blame, having been either provoked to an assault in its own way; or having inflicted the bite, with the idea of discharging a supposed duty on an aggressor. Such a wound is not supposed to contain any virus, if the animal be apparently in sound health, and of its ordinary mood; and no special treatment is required. If there be any reasonable grounds for doubt, however, let error always be approached on the safer side, and the treatment be conducted as if inoculation by virus had actually occurred. It is better that an unnecessary severity of treatment should be adopted, than that any risk should be incurred of the accession of an almost incurable disease. If the animal be undoubtedly rabid, it should be killed instantly; for very obvious reasons. If it be apparently well, and yet have inflicted the injury under suspicious circumstances, it is better to keep it in quarantine, but without the knowledge of the patient. If the animal become rabid, it should be put to death secretly; but if it remain well over the fifty days, usually allotted as the period of probation, it should be shown to the patient, as a most powerful means of reassurance.

The surgeon, when satisfied that the bite has been inflicted by a rabid animal, at once proceeds to excision, when that is practicable; and effects it in a thorough manner; carefully ascertaining the extent to which the teeth have pierced, and taking care that the knife goes beyond this on every aspect. Afterwards, it is well to apply a cupping-glass, exhausted; so as to encourage bleeding, and oppose absorption (p. 577). If there be any uncertainty as to the whole of the injured parts having been removed, let caustic be applied freely. As before stated, it is better that the patient suffer pain unnecessarily, than that any portion of the virus should be permitted to remain. Some authorities prefer caustic to excision. Mr. Youatt, for example, reposed much faith in the nitrate of silver alone. And perhaps its chemical effect on the virus may be fully equal to its destructive action on the tissues; for the latter we know is but slight. His experience and success were great—400 cases of bite, by dogs undoubtedly rabid, and not one example of hydrophobia—yet excision is surely demanded of us, when practicable, as an additional and more effectual means of security; the nitrate being afterwards employed, if deemed necessary, to render assurance doubly sure. If the part be mangled in such a way, as to render it impossible to obtain accuracy in either excision or cauterization of the bitten parts—as sometimes happens to a finger, or even to a whole hand—amputation should certainly be performed.

Along with such local treatment, it is important that the general health be attended to; and more especially, that every means be taken to maintain a state of mind free from anxious forebodings as to the result. As formerly observed, should an opportunity occur of showing the animal alive and well, that opportunity should never be neglected.

It has been said, that the bitten person generally loses no time in applying for surgical aid. But it sometimes happens that days have elapsed, ere the surgeon is consulted. And then arises a question, as to whether excision, at that period, is likely to afford a favorable chance of exemption; or whether the virus must have been already absorbed, and diffused throughout the system. This question can only be answered by experience; and experience has declared in favor of operation, even at a late period. The apparent success of such tardy operations may perhaps be explained by the fact, that all those bitten by animals truly rabid, do not fall victims to the disease; but another explanation also offers itself; namely, that local zymosis may not have been completed, and that, consequently, such excision may be in time to prevent systemic diffusion.

Dr. Marochetti maintained that characteristic pustules form beneath the tongue, near the orifices of the submaxillary glands, between the third and ninth day from the infliction of the bite; and that if these be cauterized timeously, the disease is aborted; large doses of broom tops being at the same time given internally. Most others, however, have not been able to detect these pustules. And yet it may be well to look for them. If found, they should certainly be cauterized.

Of the *curative treatment*, little can be said that is at all satisfactory. A few examples of recovery are on record; but they are only exceptions to the general rule. And, towards these recoveries, there is no striking proof that the treatment was especially conducive. There is scarcely any remedy which has not been tried; of the more important only, is it necessary to speak, and that shortly. Bleeding and other active antiphlogistics have failed, after abundant trial. Bleeding is warrantablé only in the robust, and at the very commencement of the disease; chiefly with the view of facilitating the operation of that class of remedies in which our trust will most naturally be placed—the calmatives of the nervous system. Opium, aconite, Indian hemp, belladonna, hyoscyamus, are given in large doses, often repeated, as circumstances indicate and will permit. The solid form, of pill or bolus, may be swallowed, when fluids cannot; and when deglutition in any way is found impossible, the skin, rectum, and veins yet remain, whereby administration may be effected. The hydrophobic symptoms have a close resemblance to those induced by overdoses of strychnia; and aconite is reckoned the best antidote to this poison. To aconite, accordingly, the attention of the profession has lately been directed with an increased interest, in connection with this disease. Magendie had observed, in experiments on animals, that nervous agency was remarkably subdued by injecting water into the veins, so as to induce an artificial aqueous plethora; and we have already seen that in hydrophobia the general mass of blood is black and grumous, palpably deficient in serum. Injection of water into the veins, therefore, is feasible in theory; in practice, it has been to a certain extent successful. And further repetition is perhaps warrantable, with the hope of alleviation, at all events, if not of cure; the operation, of course, being conducted with much caution, so as to guard against the dangers of phlebitis, and introduction of air. The spinal cord has naturally been attacked, in various ways. Instant vesication over the upper part of the spine, by ammonia, with subsequent endermic use of opium or other sedatives, has in some instances afforded decided relief; and is advisable. But a simpler sedative may be employed; namely, ice, in the large intestine of an animal, applied over the spine, and back of the head. The effects require to be carefully watched, however, lest the sedative result prove excessive, and fatal prostration ensue; and, further to counteract this, support by rectal nourishment should be afforded at the same time; stimulants also being at hand, if required. Ice, too, may be kept in the mouth, as an additional sedative means, and a palliation of the raging thirst. The details of a case so treated in King's College, London, under Dr. Todd,[1] are such as to hold out no slight hope of benefit, in further experience of the remedy. From inhalation of chloroform a good deal was naturally expected in this disease; but, as yet, it must be ranked only with the palliatives.

During the administration of all remedies, it is obviously of much importance to keep the patient carefully secluded from excitement by light, noise, or otherwise; and to afford what nourishment is in our power—in order to palliate and protract, if we can neither avert nor cure.

Lately it has been proposed to perform tracheotomy, in order to avert asphyxia by spasmodic closure of the glottis; but at the best, this can only palliate. And it is to be remembered that death frequently takes place, not from asphyxia, but during remission of the spasm, from mere exhaustion.

Inoculation of Virus, from a lower animal, not rabid, with or without wound.

Equinia or *Glanders.*—The horse, ass, and mule, are liable to a disease, which, according as it manifests itself chiefly in the lymphatic system, is termed *Farcy*—or in the nasal passages and skin, is termed *Glanders.* The virus of this disease, received into the human system, deranges the whole blood, as poisons usually do; and is capable of producing a series of symptoms closely analogous to those which occur in the lower animal. It is communicable both by contagion and by infection; but chiefly by the former mode. When inoculation by wound takes place, the local symptoms precede the constitutional, and are such as follow poisoned wounds in general (p. 571).

There is at first fever, of variable character; sometimes sthenic, more frequently asthenic in type; and soon followed by pains in the limbs and joints. "Hard, circumscribed, subcutaneous tumors form on the parts that are the seat of pain, in the vicinity of the joints or elsewhere on the extremities, or on the trunk. The skin covering the tumors may fall into gangrene, but they usually suppurate, and when opened, generally yield a sanious or bloody discharge. Between the fourth and the sixteenth days, a nasal discharge appears; not, however, uniformly. In some cases, this symptom is only apparently absent; pressure causing a discharge from the nose, or decubitus causing it to run into the mouth. The discharge is usually from both nostrils, is rarely abundant, is yellowish, viscid, and sometimes purulent and streaked with blood. The nose and adjacent parts are occasionally swollen; and in two cases gangrene of the nose occurred. At an uncertain period of the malady—at a mean term, perhaps on the twelfth day—a principal and remarkable symptom occurs, which consists in the appearance of a pustular eruption, or gangrenous bullæ, on the face, trunk, extremities, or genital organs. The pustules appear in succession, and usually occupy the face, arms, thighs, and anterior surface of the trunk; they have been compared to the pustules of small-pox, but their appearance is peculiar and specific. The bullæ may be followed by gangrene, varying in extent and depth. Whatever the original type of the fever may have been, it now becomes of a typhoid or adynamic character. The duration of the disease is short. In two-thirds of the cases, death occurred before the seventeenth day; one only survived on the fifty-ninth day."[1] As yet, the fatality has been almost without exception.

The disease may be either acute or chronic, in its general character; the symptoms and appearances varying accordingly. The chronic form can scarcely be said to invite higher hopes of recovery.

When there is an absence of nasal discharge, and of pustules or ulcers in the schneiderian membrane; when the characteristic eruption is present; when also numerous, soft, doughy tumors form in various parts of the surface, remote from the point of inoculation—usually on the extremities; and when these tumors are seldom resolved, but almost constantly suppurate, and sometimes pass into gangrene—large subcutaneous abscesses, also, sometimes forming in the limbs—the disease may be termed *Farcy;* chronic or acute.

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[1] British and Foreign Review, No. xxv, p. 33.

The means of prevention are sufficiently obvious. Those of cure consist in a mitigation of symptoms; by fomentation, poultice, or water-dressing of sores and pustules; evacuation of abscesses, and free incision of infiltrated areolar tissue; the use of chlorides as correctives of fetor; application of various alteratives to the sores, as their appearances may indicate; and supporting the general strength by diet and stimuli, as circumstances may require. The alterative said to be most suitable for application to the sores, is creasote in solution.

The Malignant Pustule, or Vesicle.

This may also occur with or without breach of surface; but only by contagion. And, of course, inoculation is the more rapid and certain means of communicating the disease. It shows itself chiefly in low marshy situations, in which cattle abound; and is caused by virus communicated from animals affected with typhoid disease, of which the formation of carbuncles is usually a prominent symptom. The infecting animal may be either dead or alive; the patient's cuticle may be either entire or abraded. Some have asserted that the tainted flesh taken internally, as food, will produce the disease. No doubt, serious constitutional disorder, probably of a typhoid character, will in all likelihood occur under such circumstances; and the skin may become affected by an eruption, probably degenerating into troublesome sores; yet the malignant pustule in truth does not form, as by inoculation. At all events, it yet requires to be proved that the disease is communicable either by eating diseased flesh, or by inhalation of tainted atmosphere; and, meanwhile, probability leans much towards the negative.

The disease, as occurring in the human subject, may be divided into three periods; according to the extent to which the virus has involved the tissues. 1. It is seated in the mere surface of the skin. The characters are: itching, the formation of a dark vesicle, and discharge of a brownish fluid. 2. The true skin is altogether involved. And the characters are:—the formation of a hard, painful tubercle; enclosure of the vesicle in a dark areola of the inflammatory process; and increase of abnormal sensation in the part. 3. The subcutaneous areolar tissue is implicated. All the local symptoms are increased; swelling is great and tense; pain is hot and burning; the vesicle has burst, and discloses a sloughing phagedena; and this extends with more or less rapidity. By this time, also, the system has become fully contaminated; fever of a marked typhoid character sets in, and may rapidly carry off the patient.

The hands, being the parts most liable to contact of the deleterious matter, are the most frequent seat of the disorder. The persons most commonly affected are butchers, tanners, and others, whose occupation brings them into contact with animals, or animal remains.

The indications of treatment are, to arrest the action of the putrid virus, and to avert or diminish the constitutional result. The part is to be destroyed, at as early a period as possible, by an escharotic. The potential is preferable to the actual cautery; and, of the former, nitric acid and the potassa fusa are the most suitable. Separation of the slough is watched; and should the subjacent parts seem still unsatisfactory, caustic should be reapplied freely without delay. Bloodletting, at whatever stage, invariably accelerates and aggravates the general symptoms, and usually insures a fatal issue. Tonics and stimuli, regulated by circumstances, must be given from the first. Of the former, quinine is generally preferred, in large doses; of the latter, ammonia.

V. GUNSHOT WOUNDS.

This term is applied to injuries inflicted by musket or cannon-shot, by splinters on board of ship, by stones in garrison, and by the bursting of shells, &c. In military practice, they are of much more frequent occurrence than wounds of either an incised or punctured character by sword or bayonet. Bayonet thrusts are indeed most rare; that weapon being but seldom crossed in fight. The sabre tells in the cavalry charge; but "these vile guns" are the paramount consumers of human blood and life.

Gunshot wounds are always more or less of the contused and lacerated character; followed by sloughing and suppuration; and never healing but by the second intention. The sloughing is in part an immediate result; partly secondary, from excess of excitement over power; as in other contusions. Hemorrhage is seldom great, unless a large artery be directly implicated. Yet, gunshot injury being generally extensive, and arteries of some considerable size consequently certain to be more or less wounded, danger is not slight from direct loss of blood. Often, from the form of wound, little blood may show externally, while a fatal hemorrhage is advancing in the interior. The extent of injury is very various. A ball may merely graze the part, scarcely inflicting a flesh bruise; or it may impinge, so as to fracture bone, without division of the integument. It may enter a part, and lodge; or it may effect complete perforation. A limb may be carried away, as if by a rude amputation; or it may be pounded almost to a jelly, yet remaining in contact with the living trunk. The cannon ball seldom lodges. Round shot have been found imbedded in the glutei, or even in less fleshy parts; but the occurrence is rare. Lodgment of the musket bullet, on the contrary, is extremely common. The aperture made by the bullet's entrance is small, and with the margins inverted; often it appears of much less dimensions than the foreign body which has passed through it; and sometimes it may even simulate the incised character. In such cases, the ball has come from some distance, and has struck with considerable force and velocity; the aperture, consequently, is made with comparatively little bruising or tearing, and the resilient textures close upon its track. The aperture of exit, on the contrary, has its margins ragged and everted; and is usually of larger dimensions than that which marks the entrance. When the injury has been inflicted at a short distance, the aperture of entrance is comparatively large, has no smoothness in its edges, and is obviously of a lacerated character; then, too, portions of the wadding are usually impacted in some part of the track; and the surface may be marked by the grains of powder.

The pain of a mere flesh wound is often slight; the patient, if actively engaged, may hardly be aware that he has sustained injury. If a bone be broken, or a large nerve torn, however, pain is usually severe, and demands instant attention.

The shock, too, varies. As in other injuries, it may be of two kinds; mental and corporeal (p. 81). The former is temporary, may exist without any serious injury, and ordinarily gives way to reassurance. The latter may be aggravated by the former; but is itself wholly independent of the mind. The bravest, and the most actively employed, are laid prostrate by it. It is proportioned to the extent of injury, and the importance of the part affected. If a limb has been carried away by a round shot; or if an internal organ, as the lung, stomach, liver, has been implicated in the course of a bullet; the patient is found in a state more or less approaching to syncope, and struck with an alarm and apprehension over which he has no control. Whereas, by a simple fracture or flesh wound, the same patient would scarcely be disturbed from his ordinary composure. Sometimes, it is true, a certain amount of corporeal and actual shock does attend even on slight injury. But in this case it is transient; either quickly passing off spontaneously, or yielding readily to ordinary restoratives. When, however, in a case of apparently slight wound, we find much depression of system, which refuses to yield, we may be tolerably certain that what before seemed trivial is in truth severe, and that some internal organ has been seriously implicated.

And yet it is strange how the intense excitement of hot action may prevent or rather modify the shock, to a great extent; but only for a while. "A foot soldier at Waterloo, pierced by a musket bullet in the hip, begged water from a trooper who chanced to possess a canteen of beer. The wounded man drank, returned his heartiest thanks, mentioned that his regiment was nearly exterminated; and having proceeded a dozen yards in his way to the rear, fell to the earth, and with one convulsive movement of his limbs ended his career. Yet his voice gave scarcely the smallest sign of weakness."

And again, when shock does exist, in full force, it is remarkable how clear and unshaken the mind oftentimes remains. At Corunna, "an old officer who was shot in the head, arrived, pale and faint, at the temporary hospital, and begged the surgeon to look at his wound, which was pronounced mortal. 'Indeed I feared so,' he responded, with impeded utterance. . . . . . He laid his sword upon a stone at his side, as gently as if its steel had been turned to glass, and almost immediately sank dead upon the turf."

At one time, it was supposed that a shock, sufficient to cause instant death, might be sustained from mere concussion; produced by a large shot passing with great rapidity and closeness, yet without actually touching the body; and that laceration of muscles and arteries, with fracture of bones, might be occasioned in a similar way. But it is now well understood, that these are not the effects of mere "wind contusions," as they were termed; but are produced by spent balls, which have really struck—yet with so little quickness of force, as to merely bruise without inflicting an open wound. An internal cavity, as of the cranium, may sustain even a fatal concussion by the contact of a spent shot, without any signs of an outward bruise; but, usually, the signs of contusion are both apparent and extensive. A cannon ball, when first projected, passes in a straight course; but soon it assumes a curvilinear, paraboloid direction; and at the same time it rotates on its own axis—this rotation increasing with the increased distance, and the diminished velocity. Sweeping or penetrating wounds are likely to follow obstruction to the first part of its course; while, in its last stage, it may merely roll round or over the part, as a wheel passes over a limb. Attention to this circumstance tends to explain the occurrence of such latent injuries; as well as to account for the extraordinary circuitous routes sometimes taken by musket bullets which perforate.

The course of bullets is at all times uncertain. A very slight obstacle suffices to cause diversion from the rectilinear direction—as evidenced by the rebounding of round shot from water. "A button, a watch, a book, or a handkerchief, has been the means of preserving life," from the musket bullet. And a succession of such obstacles may occasion a most devious track. The aperture of exit may be found very close to that of entrance; and yet the bullet may have nearly completed the circuit of the body. Or a ball may strike the forehead, and emerge at a point directly opposite, in the occiput; as if it had perforated the cranium in a straight line, while in truth it has never been deeper than the integument. In such cases, the superficial track is marked by a discolored elevation, sometimes slightly emphysematous. In deeply penetrating wounds, the course may be equally unexpected; bone, muscle, fascia, proving the cause of diversion. A ball has entered the breast, and lodged in the scrotum; a ball may penetrate at the upper part of the breast in front, and lodge near the spine at a much lower plane. "In one instance which occurred in a soldier with his arm extended, in the act of endeavoring to climb up a scaling ladder, a ball, which entered about the centre of the humerus, passed along the limb, and over the posterior part of the thorax, coursed among the abdominal muscles, dipped deep through the glutei, and presented on the fore part of the opposite thigh, about midway down."[1]

As already stated, the nature of the wound depends on the distance at which the shot has been fired, on the nature of the foreign body, and on the force with which it has come. At a short distance, powder will penetrate by its grains, as well as burn by its explosion. At a greater, yet still limited distance, wadding will penetrate, and may inflict a ghastly lacerated wound; a circumstance often not attended to by the vulgar. Lives have often been lost—and still oftener, seriously endangered—by the reckless discharge, at close distances, of firearms supposed to be harmless because loaded only with powder and wadding. At a short distance, small shot, as in the common fowling-piece, penetrate in a mass, like a bullet; at a considerable distance, the charge scatters, and inflicts a more extensive but less deadly wound. A bullet, when near, passes tearingly into flesh; when discharged more remotely, yet still moving with great velocity, its wound is smaller and more incised; when of very distant source, it may bruise muscle and break bone, without penetrating or even wounding the integument. Slugs, and irregular portions of iron, necessarily make more extensive and serious wounds than those inflicted by bullets. The latter, impinging on bone, are apt to be flattened or otherwise altered in shape; and when so altered they may either pass onwards into flesh, or remain imbedded in bone. On a sharp ridge of bone, a bullet may be bisected; and each half, passing onwards, may perforate; giving rise to two apertures of exit.

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[1] Hennen's Military Surgery, p. 35.

Leaden pellets, and bullets unaltered from their smooth rounded form, may lodge in a fleshy part without creating much disturbance. The wound closes in the ordinary way, and perhaps about the ordinary time; the foreign body becomes surrounded by an adventitious cyst of a quasi-serous character; and may there remain for years, undisturbed, or moving occasionally from place to place; causing but little uneasiness, except during atmospheric change—when pain, sense of weight, and general discomfort in the part, are apt to assume somewhat of a barometric character. Sharp, irregular bodies, however, are seldom so tractable; the surrounding parts will not tolerate their presence; suppuration is profuse and continued; inflammatory reaccessions are frequent; nature is constantly reiterating her effort of extrusion; and quietude and closure are not obtained, until the offending substance has been dislodged and taken away. Sometimes inflammation ceases, the wound contracts, and the discharge diminishes; yet a sinus remains, communicating with the foreign body, as if indicating and waiting for its passage outwards. In this case the bullet has an envelope of a membranous character; but not shut and serous-like, as in the former case; rather mucous, and with an outlet.

Clothing may either prevent the ball's entrance, or enter and lodge along with it. A portion of shirt or handkerchief, for example, may be carried before a bullet, with its continuity unbroken, and become impacted in the wound. On pulling out the invaginated portion of dress, the bullet will roll out from its interior. Or the clothing may be cut up, and driven inwards in portions; and these are likely to lodge, while the ball may perforate and escape. Other foreign bodies, too, or substances which come to enact the part of such, may lodge, and untowardly complicate the wound; as portions of earth, stone, wood, and splinters of fractured bone. Portions of the clothing, accoutrements, and even of the body, of one soldier, may be impacted in the wound of his comrade.

Bone may be merely fractured; the injury being compound, but neither comminuted nor complicated. Or it may be broken up into many portions of a spiculated character. Or it may be simply perforated, with longitudinal fissure extending more or less widely from the aperture. Or a ball may penetrate only the external part; and lodge in the cancelli, leaving the general continuity of the bone unbroken. Projected very slowly, a ball may merely bruise the bone. But such bruise is apt to prove troublesome; exciting inflammation in a part of diminished power, and so greatly favoring the induction of necrosis.

Gunshot injury of bone, indeed, of whatever kind, is always of an unfavorable character, and prone to necrosis; being attended with much bruising of the tissue. Joints may be simply opened up; or, in addition, may have their interior occupied by foreign matter.

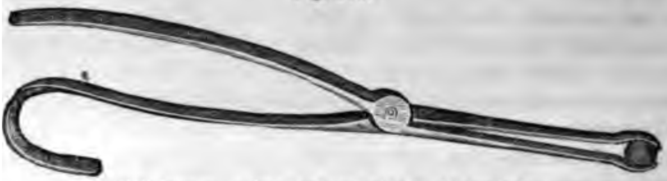
The indications of a ball, or other foreign body, having escaped, are not always plain. If there be but one aperture, that of entrance, the natural inference is that lodgment has taken place. Yet there is an exception to this; when the ball has been lodged in a portion of the clothing carried before it, and has escaped on the evulsion of that portion at the time of undressing the patient; also, when the ball has made a complete circuit, and come out at the same spot at which it entered—as has occasionally happened in the head. When, on the contrary, there is plainly the aperture of exit as well as that of entrance—and the two are nearly in a straight line, or otherwise placed as circumstances would seem to render likely—the probability is that the ball has perforated and escaped. And yet we may be mistaken; for it may have been divided on bone, as formerly remarked, and one part only may have passed out, while the other remains impacted. Or two apertures, nearly in a line, may both be of entrance; made by two distinct balls, which have lodged. Also, a plurality of openings does not imply a plurality of bullets. The same bullet may perforate and escape, and perforate again; or, after perforation, it may be subdivided into two or more fragments, and each have its separate aperture of exit.

The true extent and danger of a gunshot wound can scarcely be determined, until suppuration has been established. Then the sloughs become detached; not necessarily involving the whole track; greatest usually at the point of entrance. And on separation of the sloughs, bones, joints, arteries, cavities, and canals, may be exposed, which previously were deemed unimplicated.

The accidents which are liable to occur during the progress of cure, are many and formidable; excess of inflammation, and of inflammatory fever; erysipelas; abscess after abscess, by inflammatory reaccession, probably connected with the lodgment of foreign matter; diffuse purulent infiltration; inflammatory affection of veins, either in the hard or soft tissues, perhaps of the diffuse and suppurative kind; untoward extension or recurrence of sloughing; hemorrhage on the separation of sloughs, or by subsequent ulceration; accession of sloughing phagedena; non-union of fracture; necrosis; caries; exhaustion by hectic; tetanus.

Treatment.—Gunshot wounds are amenable to the rules of treatment adapted to contused and lacerated wounds in general; the leading indications being:—to watch, and if necessary, to expedite disappearance of the shock; to remove foreign matter; to readjust the parts, and place them in a comfortable and relaxed position; to moderate the coming inflammation; to promote the separation of sloughs; to favor the contraction and consolidation of the wound; constitutionally, to moderate the effects of local excitement, in the first instance, and subsequently to support the frame for the perhaps protracted efforts of repair. The accidents, when they threaten to occur, are to be met by the ordinary means. It is obviously of much importance to ascertain at the outset whether foreign matter has lodged or not. This is effected by gentle yet determined probing, and manipulation of the wounded parts; it being well to place the patient, during such examination, in the position which he occupied at the time of the injury, and then to reason on the most likely course of the bullet. When the foreign body is felt plainly in the track of the wound, it is to be removed immediately, by the finger or forceps; the wound being dilated, if need be. If found superficially lodged beneath the integument, it is to be cut down upon and taken away. But if found deep and firmly impacted, it is well to wait for the suppurative stage; and, during the relaxation of texture which then occurs, to make the attempt at removal—at a time when the foreign body itself, in obedience to the general law, has begun to seek the surface. In regard to bullets deeply lodged, it ought also to be remembered that they may become encysted and quiescent, giving little or no uneasiness, and may remain so for years; or that, at some future period, they may approach the surface, and ultimately, as it were, invite their own removal.

Fig. 216.



Ball-forceps; in the act of removing the foreign body.

When a bullet penetrates the abdomen or thorax, and cannot be removed, copious and repeated bleedings are advisable, along with the most rigid antiphlogistic treatment.

When a bone has been struck, or even grazed, very careful examination is necessary—assisted by incision, if need be—in order to ascertain whether splintering has occurred or not. For recent experience in Paris seems to have shown, that unless all bruised and splintered fragments are thoroughly removed at the time, these portions become necrosed, and serious consequences by inflammation and suppuration are certain to ensue.[1]

But, very frequently, the surgeon's first care is to determine whether the injured limb is to remain, or whether amputation is expedient. The settlement of this question will be mainly influenced, by the probability of the occurrence of gangrene; by regard to the power of system in the prospect of a tedious and suppurative cure, as influenced by age, habits, and previous condition; by the probability of the limb proving useful, or otherwise, if retained; and by regard to the disposable means for conducting the treatment.

If it be determined to remove the limb, a second question arises as to the proper time for doing so; whether the amputation shall be primary, performed before inflammatory accession; or secondary, after the suppurative stage has been established, with decadence of the constitutional inflammatory symptoms. In military practice, there is now little diversity of opinion on this subject; decided preference, for very obvious reasons, being given to the primary operation. The shock having passed off—as usually happens within a few hours—the part is taken away during the interval of systemic repose, between depression and excessive reaction; a period whose average range is from eight to sixteen hours. The mangled limb is converted into a simple flesh wound; and the dangers of gangrene, high inflammatory fever, and hectic, are removed by anticipation.

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[1] The same experience tends to modify the statements made at p. 587, in regard to the apertures of entrance and exit. During the "Three Days," many examples occurred at the Val de Grace, in which the aperture of entrance was the larger of the two. For dressing the vast variety of gunshot wounds which then occurred, constant application of ice was generally preferred, leaving the wounded part otherwise wholly uncovered.

Certain circumstances are usually understood to render the performance of amputation either essential or expedient. 1. When a limb has been carried away, leaving a shattered and unseemly stump. To refrain from amputation in such a case, were willingly to encounter immediate risk by gangrene; subsequent danger, by hectic, under a wasting and long-protracted suppuration; and certainty of the stump, even when healed, proving unserviceable. 2. When a limb has been struck by shot, and shattered, although not carried away; when bones are broken, bloodvessels and nerves torn, and muscles bruised to disorganization; gangrene is inevitable, and operation imperative. 3. When a mass of the soft parts has been carried away, involving the principal vessels, yet without injury to the bone; or when, the main vessels remaining entire, the rest of the limb is hopelessly shattered and bruised; still grangrene is certain, and amputation demanded. 4. When the part is crushed to disorganization, without wound of the integument; as by a spent ball; a state evidenced by the pulpy, loose feel, coldness, and impaired sensibility of the part. 5. When joints are opened, and the bones composing them broken. This applies, almost without reservation, to the hip, knee, and ankle joints. But the joints of the upper extremity are in many cases exempt, and seldom afford an unqualified indication for immediate removal; there being in this part of the body a much greater tolerance of injury, as well as power of repair. 6. Compound fractures of the thigh, more especially at its upper part, are usually found to proceed untowardly; and, therefore, the majority of such cases are held to demand primary amputation.

However plainly the local injury may render amputation necessary, it is obvious that the operation should not be performed unless there exist a reasonable prospect of success. For example, if a patient be mortally wounded in an internal organ, besides having sustained severe injury of a limb, it were sad surgery to shorten his doomed life by the exhaustion of an operation directed towards the lesser evil.

Secondary amputation becomes imperative, in the case of a limb which we had hoped to save, when spreading gangrene occurs, or when the frame is obviously yielding under an otherwise uncontrollable hectic. A second amputation may also be rendered expedient, when the stump which resulted from the first operation proves unsatisfactory; in consequence of sloughing or ulceration of the soft parts, or exfoliation of the bone.

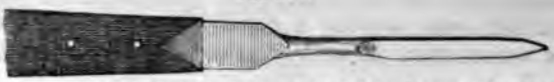
The occurrence of tetanus may, under some circumstances, perhaps, be held a warrant for amputation; if so, the operation should be performed at an early period of the disease.

Secondary amputations usually prove more successful in civil than in military practice; a circumstance to be explained by the usually superior accommodation and convenience for treatment.

VI. SUBCUTANEOUS WOUNDS.

Perhaps these may be arranged as a sixth class of wounds; belonging to the class of incised, but peculiar in their mode of production. They are designedly made, by the hand of the surgeon, with some curative object in view. Their paramount principle is, thorough exclusion of atmospheric air from the cut part. By the absence of such stimulus, inflammation is avoided; and union occurs by adhesion; without pain or pus, and within few days after infliction. A narrow knife or needle, of very delicate edge, is introduced obliquely beneath the integument, at a little distance from the part to be divided; by a turn of the knife, when passed to the necessary extent, division is, as it were, stealthily effected; the instrument is then withdrawn, if possible still more cautiously than it was entered; the aperture is instantly closed, and retained in apposition by suitable dressing. Thus air is effectually excluded, and the object in view attained.

Fig. 217.



Tenotomy knife; narrow blade, and single edge; very suitable for most subcutaneous wounds.

Accidental wounds often burrow beneath the skin; perhaps to a considerable extent. But these, usually, partake more of the contused and lacerated, than of the incised character. They inflame, almost invariably; and often it is an early duty of the surgeon, in their treatment, to undo their subcutaneous character, by free incision; so as to avert disaster, otherwise likely to occur, in consequence of acute suppuration.

TETANUS.

This is a disease of the true spinal system; the cerebrum being unaffected until a very advanced period of the case, when delirium or stupor supervenes, shortly before death—as in many other affections primarily unconnected with the nervous centres. The characteristic symptom is true spasm and rigidity of the voluntary muscles. And, according to the extent and predominance of the muscles affected, various terms are applied. When the muscles of the neck and face alone are involved, fixedness of the jaw is the most prominent symptom. Hence the vernacular term of Lock-jaw; and this form is called *Trismus*. When the muscles of the front are chiefly affected, bending the body forwards, it is said to be a case of *Emprosthotonos*. While *Opisthotonos*, of much more frequent occurrence, denotes the opposite condition; predominant affection of the posterior muscles bending the body backwards, like a bow, until in extreme cases the resting points are the heels and occiput. Bending to either side is termed *Pleurothotonos.* And the strict acceptation of the term *Tetanus* denotes involvement of all classes of muscles, without preponderance of action in any; whereby the body is rendered rigid and straight. The ordinary use of the word, however, denotes the disease in general, and includes all its varieties.

Whatever form occurs, the disease may be either *Acute* or *Chronic;* the former a most formidable malady, seldom admitting of cure, tending to involve the whole frame, and unfortunately the more frequent in occurrence; the latter milder in all its phases, more inclined to be partial, and much more amenable to treatment. The disease is also said to be either *Traumatic* or *Idiopathic;* the former following wound, or other injury, and usually acute; the latter of spontaneous origin, without any external and assignable cause, and usually chronic.

The most frequent form is that which is traumatic and acute; and the symptoms and character of this may be taken as typical of the disease in general. It is more frequent in hot climates than in temperate; in military than in civil practice; in children and the middle-aged, than in youth and the far advanced in years; in men than in women. The existence of a wound is not essential; it has followed simple fracture, and a blow or bruise—even apparently slight. It has also followed a mere fall, without any apparent bruise; and it has been induced by the unsurgical operation of tooth-pivoting. Wounds, however, are the ordinary exciting cause; especially those of a punctured and lacerated kind, inflicted in dense textures well supplied with nerves—as the fingers and hand. There is good reason to believe, that injury done to some individual nervous branch is prominently connected with accession of the symptoms; that it has been punctured or torn, or partially divided, or included in a ligature applied to a bleeding artery; or that it is continually excited and injured, by some rough or sharp foreign matter lodged in the wound.

The predisposing causes of tetanus are not easily ascertained. But it seems quite certain that intestinal and uterine irritation, especially the former, act in this way; as also exposure to atmospheric vicissitudes. And these, again—which, with wound, rank as predisposing causes—may, without any breach of surface, become existing causes of the idiopathic form of the disease.

The period of accession varies. In some cases, the symptoms appear within a few hours after infliction of the injury; in others, a few days elapse, and the accession is while symptoms of acute inflammation are present in the wound. More frequently, cicatrization is nearly complete; and in such cases, it has been supposed that the exciting cause is a neuromatous formation in the injured nerve, which has become entangled in the dense cicatrix, and is thereby irritated (p. 551). Certainly, such a morbid condition has been found in tetanic cases; more especially when following burns. When three weeks have elapsed, without any threatening of accession, the patient may usually be considered safe. Whereas, in hydrophobia, it will be remembered, invasion is seldom till even a more distant period (p. 579).

In Tetanus there is a peculiarly "excitable state of the Spinal Cord and Medulla Oblongata, not involving the ganglia of special sense. This may be the result of causes altogether internal, as in the idiopathic form of the disease; in which the condition exactly resembles that which may be artificially induced by the administration of Strychnine, or by its application to the cord. Or it may be first occasioned by some local irritation, as that of a lacerated wound; the irritation of the injured nerve being propagated to the nervous centres, and establishing the excitable state in them. When the complaint has once established itself, the removal of the original cause of irritation (as by the amputation of the injured limb) is seldom of any avail; since the slightest impressions upon almost any part of the body are sufficient to excite the tetanic spasm."[1]

The nerves concerned in deglutition are generally first involved by the spinal irritation; and the obedient action of the muscles produces distortion of the mouth, with pain and stiffness in the neck and jaws—usually the first symptom. If the orbicularis oris predominate in action, the mouth assumes a puckered appearance; more frequently the antagonist muscles are in the ascendant, causing a ghastly smile. Dryness and soreness of the mouth are felt; swallowing and mastication are difficult; the neck becomes more and more rigid; and attempts to swallow are apt to induce convulsive efforts, perhaps threatening suffocation. Ultimately, the jaw becomes firmly closed; the masseters and temporals feeling hard and bulging. All the muscles of the face are involved. The forehead is much wrinkled, both longitudinally and transversely; and the eyebrows, by the action of each corrugator supercilii, are closely approximated, forming a sharp angular curve at their inner and highest part. The eyes, usually, are not fully opened; the orbicularis and levator seeming almost to neutralize each other. The eyeballs are distorted, and fixed. The nostrils are dilated. The angles of the mouth are drawn much backwards, and (the elevators predominating over the depressors) are somewhat elevated. The orbicularis oris binds the lips firmly on the teeth; which, however, are now always more or less seen, and sometimes wholly disclosed. The expression is indicative of much suffering, and quite peculiar to the disease; it may indeed be said to be pathognomonic. The marked change of countenance has not been long assumed, when a distressing pain occurs at the lower part of the sternum, shooting backwards in the direction of the diaphragm; accompanied by spasms of that muscle, impeding and disturbing respiration. This is the first of the involuntary muscles which is affected. They now, however, become more and more involved. The spasms are more intense; sometimes remitting even to a considerable extent, but never undergoing complete intermission. Exacerbation is induced by the slightest external cause. In general, the whole body becomes fixed and rigid; occasionally distracted by convulsive movements. The abdominal muscles are especially affected; the recti have been torn by the violence of contraction. The arms usually are the last disordered; and the fingers sometimes continue mobile to the last. The tongue, too, remains long free; when affected, it tends to protrude, is bitten by the teeth, and bloody saliva trickles from the grinning mouth, fearfully aggravating the already horrible expression of countenance. The sphincters are usually contracted. The bowels are obstinately constipated; partly from the cause just stated; but mainly from inherent derangement of the functions of the whole alimentary system. When movement is obtained, matters much changed from the normal state, and of remarkable fetor, are passed in great abundance; showing great derangement of the intestinal canal to be a marked and invariable symptom. And, as already stated, this derangement may also, with much probability, be considered as connected with the origin of the disease. There is difficulty in passing water, from spasm of the muscular fibres at the neck of the bladder, and in the perineum; occasionally there is marked relaxation of these, during which the detrusor may squirt forth the urine with much force. Intense pain accompanies the spasmodic exacerbations; and there is generally a profuse perspiration from the whole surface, said to have a peculiar and pungent odor. The pulse at first may be both strong and full; but it soon falls from the sthenic type, becoming weak and indistinct. No delirium, or other apparent disorder of the cerebral function, occurs, until shortly before death. As in hydrophobia, the patient perishes either by asphyxia, during a spasmodic paroxysm; or of exhaustion, during a period of remission; most frequently in the latter mode. It is also possible that death may occur suddenly, from the muscular fibres of the heart having become involved in spastic rigidity. The duration of the disease is seldom beyond a few days, in the acute form. The chronic may continue for more than a fortnight; and then there is usually recovery.

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[1] Carpenter's Physiology, p. 517.

The morbid appearances found after death are similar to those in hydrophobia; and, likewise, are far from uniform in their nature. The brain seldom shows aught amiss; unless it be an unusual amount of serum. The spinal cord usually evinces manifest congestion, both in itself and in its membranes; more especially at the origins of the nerves; and the amount of serum is preternaturally and considerably increased. The lungs are congested; there is unusual vascularity of the air passages, and of the pharynx, œsophagus, and stomach; but sometimes these canals retain a diminished calibre, the spasmodic contraction having not yet ceased in death. The nerves at and leading from the injured part, usually show increased vascularity, enlargement, and other signs of the inflammatory process, either chronic or acute (p. 545).

In the traumatic form, it is in the nerves of the part that inflammatory change is to be looked for, rather than in the spinal cord; for the disease is to be regarded as an extreme example of *Irritation*, in the whole true spinal system, induced by inflammatory products in some portion of its periphery. The centre, no doubt, suffers by some vascular change also; but this is secondary, and in all probability seldom if ever amounts to true inflammation.

Myelitis—the inflammatory process in the spinal cord—induces symptoms of a tetanic character. The case is one of an inflammatory nature throughout; and change of structure, more or less marked, is found in the medullary substance. But this is altogether different from true tetanus.

Treatment.—Prevention is likely to be accomplished:—in the first place, by avoiding the class of wounds most prone to prove prejudicial in this way; in the second place, and mainly, by adopting the simple, non-irritating treatment of all wounds, such as we have endeavored to inculcate. The disease having occurred, the indications of treatment resolve themselves into those which regard the part, and those which regard the system.

As to the part. Amputation has been proposed and practised, but with indifferent success. It can be of use only at an early period of the case, as already observed. The result of my own experience is favorable to the minor operations; unfavorable to the larger. Unless some urgent state of the part itself (as sloughing, infiltration, hemorrhage), rendered its removal necessary, I should not feel warranted in performing any of the greater amputations, in the hope of relieving tetanus.

Incision, made to surround the part on its cardiac aspect, deep and wide enough to cut off all nervous communication, is plausible in theory; and experience already has spoken somewhat in its favor. It is a simple and safe procedure, and may often be practised when amputation cannot. For the latter operation, at an advanced period, is in no circumstances warrantable; the shock and loss of blood being certain to accelerate the fatal issue. Should any painful operation be deemed expedient, the use of anæsthesia will be especially productive of good in this disorder, as can be readily imagined; not only relieving pain and shock, but also saving the nervous system from otherwise highly injurious excitement.

The actual cautery is by some recommended for the wounded part, but upon what rational grounds, it is not very easy to discover. On the contrary, the treatment there should surely be of the bland and soothing kind; as water-dressing, or light poultice—hot, and medicated by sedatives, as opium, or belladonna; incision, however, being never withheld, to relieve tension, evacuate abscess, or arrest diffuse infiltration.

As to the system. Bleeding, in genuine tetanus, is not expedient to any great extent. If used at all, it must be early, and with a sparing hand; and, as in hydrophobia, rather as an adjuvant to other remedies, than itself a means of cure. Purging is essential, as can readily be understood; there is much filth to be dislodged from the interior, and much depravity of the intestinal secretion to be corrected. Croton oil, elaterium, or calomel, occupying little bulk, may be got over without much difficulty; and are to be continued, till the bowels respond freely to their use. Their operation will be well assisted by terebinthinate injections *per anum*. Then, the attention is naturally directed to the most powerful of the sedative remedies; and of these the disease generates a remarkable tolerance. Opium has been given in large quantity; but proves comparatively inert; lodging, little altered in the stomach—the function of digestion being probably much in abeyance. Lately it has been proposed to administer it in the form of fume, à la Chinois; an expedient not irrational, and worthy of trial. Belladonna has been given in large doses; one, two, three, or even four grains of the extract every two hours; and frictions, with the tincture, over the affected parts, sometimes have seemed to afford relief.[1] The cannabis indica has, in warm climates, greatly alleviated the symptoms; and, in some cases, seems to have contributed powerfully towards cure. In this country, its success has not hitherto been so great; and yet such as fully to warrant further trial. My own experience speaks loudly in its favor. I can now record three fortunate cases under its use; all traumatic. A girl, eleven years of age, sustained comminuted fracture of the finger. Tetanus occurred, the finger was amputated; and the treatment consisted of purgatives, cold to the spine, Indian hemp—pushed to narcotism—nourishment and seclusion. The amendment was gradual and complete.[1] A boy, about the same age, had simple fracture of the thigh, with compound and comminuted fracture of the great toe. The treatment and result were the same. Another boy, rather older, had compound fracture of the bones of the arm. The treatment again resulted in cure. And in these cases I was, and am inclined to award to the cannabis the greater part of the therapeutic agency. In other examples of the disease, I have seen it fail to cure, but never to relieve. It is given in doses of three grains of the extract, or thirty drops of the tincture; repeated every half hour, or two hours; the object being to produce and maintain narcotism. There is a very marked tolerance of the remedy.

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[1] Lancet, May, 1844, p. 275; Monthly Journal, Retrospect, Nov. 1848, p. 245.

Tobacco is a most powerful sedative, and is administered in the form of enema; a drachm to the pound of water, and the half given at a time; repetition being made according as circumstances may demand. Let it never be forgotten, however, that this remedy may readily become a poison; and that large doses, or reckless repetition of even small quantities, may wholly prostrate the powers of life, and carry off the patient. Each dose must be cautiously given, and its effects carefully watched; and while, with the tobacco, we endeavor to allay nervous excitement and muscular spasm, with nutriment and stimuli we sustain the powers of life; finding this combination of a sedative with stimulus not only expedient but essential. The warm bath has a relaxing effect on the muscular system; and this is much enhanced by medication of the water with antimony; from two to six drachms of the tartrate of antimony being dissolved in an ordinary bath. The remedy, however, requires care, like the tobacco; lest it prove excessive.

Counter-irritation over the spine, with the endermic use of sedatives, may do good. Morphia may be sprinkled on the raw surface, or aconitine, or belladonna; and for the same reasons as stated in the case of hydrophobia, probably aconite may be the most hopeful of the three (p. 581). Or, instead of counter-irritation, cold may be applied continuously to the spine, especially to its upper part; its effect being narrowly watched, lest it prove excessive; stimuli, and support of the general system, being at the same time given; as in the use of tobacco.

Throughout the whole period of attempted cure, the utmost quiet and seclusion should be observed; all noise, light, and prying visitors being excluded. Nourishment should be given, to as full an extent as circumstances place in our power; by the mouth, if possible; by the rectum; and by the skin. By nutritive enemata and baths, life may be prolonged for some considerable time after the power of swallowing has gone; and

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[1] Edinburgh Monthly Journal, Jan. 1845, p. 22.

—as bearing upon this point—it is to be remembered, that the greater number of patients usually die of exhaustion.

Mercury pushed to ptyalism, has effected cures in hot climates; in this country it has proved less successful. Lately, the subnitrate of mercury, in doses of ten grains, has been strongly recommended. Its effects are purgative, emetic, and diaphoretic; and the spasms are said to relax greatly, when these results have been obtained.

The breathing of chloroform has relaxed spasm and annulled suffering, for a time. And the use of this wondrous agent has certainly contributed, if not to the cure of tetanus, at least greatly to alleviation of its symptoms.

The wourali poison is esteemed the most direct, powerful, and simple of sedatives; an animal poisoned by it "sinks from existence in the most placid swoon." The nervous system is chiefly acted on; and, after apparent death, from cessation of nervous function, the heart's action may be continued for some time. When no large quantity of the poison has been administered, artificial respiration—maintaining the heart's action—will sustain life; until the poisoning influence has passed away, and the nervous system has rallied from its temporary paralysis. At one time it was supposed, naturally enough, that such complete rest afforded to the previously racked spinal system, even though of short duration, might be followed by the best curative effect; that on resumption of nervous function, the tetanic symptoms would be found to remain partly or even altogether in abeyance; and that either an immediate exemption from the symptoms, or palliation and a partial approach to cure, might thus be obtained. The proposed mode of application to the human subject, was to insert a small quantity of the poison into a puncture of the hand or arm; regulating its introduction into the system, and its effects there, by tightening or relaxing a ligature on the cardiac aspect of the wound. Experiments on the lower animals, however, have resulted only in disappointment; and application of this remedy to man were now scarcely warrantable.

On the whole, I should be inclined to arrange as an eclectic constitutional treatment:—absolute quiet and seclusion; purgatives, to clear thoroughly the primæ viæ, afterwards stimulant enemata to maintain intestinal action; nourishment given often, in small quantities; cold to the spine, by ice in bladders—applied constantly, if not proving over-sedative; Indian hemp, *pushed*, so as to maintain moderate narcotism; inhalation of chloroform, employed cautiously and occasionally, to alleviate, paroxysmal accession.

In chronic tetanus, the principal remedies are purgatives, continued until a satisfactory result has been obtained upon the intestinal canal; support, by nourishment; and gentle use of the antispasmodics. Heroic remedies are neither necessary nor expedient; recovery being as common in this, as it is rare in the acute form. After the tetanic symptoms have subsided, tonics are necessary, along with support; to remove the state of debility which tends to remain.

The means of diagnosis between tetanus and hydrophobia have been already noticed (p. 580). Hysteria sometimes achieves a very close simulation. And yet it is capable of being readily distinguished by the careful observer; spasm and rigidity being more decidedly paroxysmal, possessing periods of complete intermission, and evidently being to a great extent within control of the patient's will; also, the ordinary signs of hysteria are present, usually in a distinct and prominent form.

On Wounds in general, see John Bell, on the Nature and Cure of Wounds, Edin. 1812; Roux, sur la Reunion Immediate, Paris, 1814; Dupuytren, des Blessures par Armes de Guerre, Paris, 1834; Sanson, de la Reunion Immediate, Paris, 1834; Macartney on Inflammation, Dublin, 1838, p. 185; Dieffenbach, on the Division of Tendons and Muscles, Berlin, 1841; Liston's Practical Surgery, Lond. 1846. See also the references under Inflammation and Repair.

On Gunshot wounds, see Larrey, Memoires de Chir. Milit. Paris, 1812–17; Guthrie on Gunshot Wounds, &c., Lond. 1815; Hennen's Military Surgery, Lond. 1829; Ballingall's Outlines of Military Surgery, Edin. 1844; Waters, in Monthly Journal, October to December, 1848; Des Plaies d'armes à feu, Paris, 1849.

On Poisoned Wound, Hydrophobia, Glanders, and Malignant Pustule, see Fontana, Traité sur le Venin de la Vipere, &c., Florence, 1781; Blane, Outlines of the Veterinary Art, Lond. 1816; Marochetti, Observations sur l'Hydrophobie, &c., Petersburg, 1821; Chomel, Dict. de Med. (Art. Hydrophobie), tom. xi, Paris, 1824; Elliotson on Glanders, Med.-Chir. Trans. vols. xvi and xviii; Barry, on Prevention and Cure of Symptoms caused by Bites of Rabid or Venomous Animals, Lond. 1826; Hoffmann der Milzbrand, &c., Stuttgardt, 1827; In Hufeland's Journal der Praktischen Heilkunde, 1828; Reviewed in Ed. Med. and Surg. Journal, vol. xxxii; Hertwig, Beitrage zur naheren Kenntniss der Wuthkrankheit oder Follheit der Hunde, Berlin, 1829; Bardsley, Cyclop. of Pract. Med. (Art. Hydrophobia), vol. ii, Lond. 1832; Levin and Rayer, on the Diseases transmissible from Animals to Man, Brit. and For. Review, Jan. 1842; Bourgeois, Memoir sur la Pustule Maligne, Archives Gen. Ch.-Med. vol. i, Paris, 1843; Blake, on the Action of Poisons; Christison on Poisons, 4th edit. Edin. 1845; Youatt, on Rabies, Lond. 1845; Ellis's Clinical Surgery, Dublin, 1846.

On Tetanus, see Trnka de Krzowitz, Commentarius de Tetano, Vien. 1777; Larrey, Mem. de Chir. Milit. vols. i and iii; Dickson, Observations on Tetanus, Med.-Chir. Trans. vol. vii, Lond. 1816; Swan, on Tetanus, Lond. 1825; Symonds, Cycl. of Pract. Med. (Art. Tetanus), Lond. 1835; Travers, Further Inquiry concerning Constitutional Irritation, Lond. 1835; Curling on Tetanus, Lond. 1836; Todd, on Tetanus, Lumleian Lectures, 1849, Med. Gazette.

CHAPTER XIX.

OF BURNS AND SCALDS.

Burns and Scalds denote injury done by excessive heat; applied in the former, by radiation, by flame, or by solids; in the latter by heated fluids or vapor. Those inflicted by flame, heated oil, and steam, are the most severe; the temperature, and intensity of combustion, being great.

The dangers of this form of injury are various; even to a greater extent than wounds, they are not mere casualties happened to a part. 1. There is a shock imparted to the system when the burning is extensive and severe, or involves an important part; and under this shock the patient may perish, by syncope. 2. Imperfect or nervous reaction may result, to an excessive and uncontrollable degree; the patient sinking exhausted, under febrile tumult of the asthenic kind, at a very early period (p. 82). Sometimes a deceptive lull precedes this form of reaction. An elderly patient, badly burned, may walk to hospital, and yet be dead in forty-eight hours. 3. Or reaction of the sthenic type proves excessive; and under the violence of inflammatory fever life may be endangered. 4. During the progress of inflammatory fever, the internal organs, more especially the lungs, are apt to suffer; seriously complicating the case. At a more advanced period, fatal disease of the intestinal mucous coat may occur. 5. More remotely, tedious cicatrization, confinement, and discharge, are prone to peril the system by hectic. Death escaped, life may be rendered very miserable, by the deformity and impairment of function often inseparable from healing of the burn.

The classification, at once most natural and most useful, is according to the extent to which the textures have sustained injury. I. The mere surface is involved, by a slight and temporary application of heat; usually in the liquid form. A mere erythema results, usually terminating in resolution; but not without risk, when occurring in the scalp, or when including a large range of any part of the surface. II. The cutis undergoes the inflammatory process of a higher grade. Pain, swelling, and tension, are followed by vesication; and the vesicles may either suppurate, or disappear by desiccation. The heat may have been applied either in the fluid, or in the solid form. In the latter case, it is not uncommon for the cuticle to adhere to the heated substance; then no vesication forms, but, instead, a raw surface is left, of exceeding tenderness, which speedily inflames and suppurates, and probably is extended by acute and painful ulceration. This circumstance, occurring accidentally, well illustrates the importance of retaining the cuticle unremoved, and as little disturbed as possible, in those cases which are under treatment with vesications already formed. III. By a greater application of heat, in the solid form, or by flame, the external part of the cutis is cauterized; killed immediately, or almost so; and converted into an insensible slough, of a darker or lighter color according to the rapidity with which it has been made to part with its vitality. Though the surface be insensible when lightly touched, yet acute pain is elicited by pressure. If the part have died instantly, there is no change in its character; it is at once an eschar, and remains so until detached. But when its death has been subsequent to the injury, and a gradual although still a rapid process, dark vesications may form, as in ordinary gangrene. After separation of the slough, the pain, which had almost ceased shortly after infliction of the injury, is renewed, of a very intense character; in consequence of the sensitive cutis, which had been but half destroyed, now constituting the raw and inflaming surface. This, in truth, is the most painful of all burns; and, as formerly observed, ought to be avoided, when such injuries are inflicted by design, with a curative object in view. By gunpowder, this class of burn is often produced; and, in such cases, the surrounding skin is begrimed by lodgment of the grains. IV. The skin is wholly cauterized; at once converted into the state of eschar, dark-colored, dry, and insensible. The dead portion contracts, in its change; and, consequently, the surrounding integument presents a puckered appearance, so long as the eschar remains adherent. Pain is acute during the burning, but soon subsides; and, for a time, is almost entirely absent. On inflammatory accession, necessary for detachment of the eschar, pain returns; but not of the inordinate degree which invariably attends the like stage in the preceding class of injury. This is the form which it should be our object to produce, in using the actual cautery. V. The cauterization extends deeply; producing a sonorous, black, brittle, and depressed eschar, more or less extensive; slow in separating and followed by much suppuration; forming a wound very tedious in its progress towards cure. And the cicatrix is usually of an unsatisfactory kind, when obtained. VI. The entire thickness of a limb is reduced to the state of eschar; and removal by amputation is demanded. The spontaneous separation is slow; besides, a bad stump is formed, and the system is under much danger by protracted hectic.

In general, these various classes are more or less blended. For example, in the centre of a burnt part, where heat has been most intensely applied, there may be the depressed eschar; exterior to that, the skin only in part destroyed; beyond this, the skin, alive, and about to be actually inflamed; and, exterior to all, such an amount of injury as will produce but an erythema. The most severe examples of the injury are usually those caused by flame, as when the clothes have taken fire; for the part is made to contribute towards its own combustion; and this is intense and rapid.

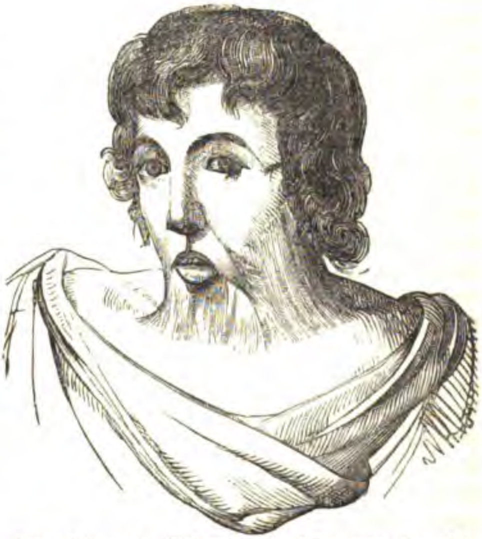
As regards prognosis, it is important to remember, that loss of substance often proves more extensive than it at first seemed. A part dies immediately; but another, and sometimes a larger portion, perishes subsequently, under inflammation; the heat was insufficient for immediate extinction of its vitality, yet lowered this so far as to render it unable to withstand even the ordinary inflammation which invariably ensues. And thus, the immediate eschar may come to appear insignificant, in comparison with the subsequent slough. In cases suspected to be severe, it is always a favorable sign to find vesications form; denoting that the part still retains at least a certain amount of vitality. Prognosis is further dependent, not only on the extent of injury, but on the previous state of the patient's system, and on the nature of the part whereto the injury has occurred. Burns are most dangerous on the head, neck, and trunk; as also those which affect the genital organs, at a tender age.

The constitutional symptoms have been already noticed. There is first the shock or state of depression; from which reaction takes place, of either a sthenic or an asthenic kind; usually the former, unless the accident be very severe, or the system previously much enfeebled. Then comes inflammatory fever, more or less violent, accompanying the inflammatory process which necessarily ensues in the part. About this time, the constitutional symptoms are apt to become unpleasantly complicated, by evidences of acute affection of the internal organs. The lungs are prone to suffer, by inflammatory affection of the bronchial membrane; and also by engorgement of the pulmonary tissue. Subsequently effusion may occur in the pleural cavity; the mucous lining of the intestines, more especially of the duodenum, is apt to ulcerate; and the brain may become the seat of serous accumulation. The inflammatory stage having passed, the symptoms abate; if the sore left be slight, and the progress towards cure satisfactory. Otherwise hectic sets in; and, in the more extensive and protracted cases, this in its turn gives way to confirmed collapse. The extremes of age—childhood and senility—are more liable to suffer untowardly, than adolescents and adults; as can readily be understood.

The process of cure is uniformly tedious. A portion of the burnt part usually dies; either immediately, or subsequently under inflammation. This must be detached; and ulceration accordingly supervenes. On subsidence of this, reparation is begun; at first energetically enough; but the effort soon flags, and progress is slow and uncertain. The injury has effectually impaired the vital power of those parts on which the burden of the reproductive effort is thrown; and they are not equal to its efficient sustentation. Besides, there is much loss of substance; the production of new matter to fill the gap, as has just been stated, soon comes to be scanty; the healing result is, in consequence, mainly to be effected by contraction of the surrounding original textures; and, whenever there is much to do in this way, a long time is always required to do it. But, besides the fact that contraction and cicatrization of the sore produced by burning is always tedious, from the same cause there is also a proneness to produce deformity. For, by contraction of the original textures, much displacement in the relations of neighboring parts is likely to ensue; all the more, in consequence of such contraction not ceasing on cicatrization being completed, but continuing for some time afterwards. So much have the reproducing parts had their powers weakened, they not only form little new substance, and leave the greater part of the closure to contraction of the original textures; but the little new which is produced is imperfectly organized; and, consequently, like all similar adventitious structures, it is prone to disappear, or at least to diminish, by absorption. The peculiarities in the healing of burns, then, may be shortly stated to be; that they heal slowly, and much more by contraction of the old structures than by the formation of new; the new matter is imperfectly organized, and liable to absorption; and, consequently, contraction continues, for some considerable time after completion of the cicatrix.

Treatment.—No class of injuries has been more the subject of empirical treatment than burns, even in the profession. And yet the indications can be laid down, as plainly as in any other affection. 1. *Assuage locally.* The smarting pain of even a slight burn is not easily borne, and the sufferer seeks anxiously for relief. If he be seen immediately after the infliction, there is nothing better than instant immersion of the part in cold water; where it is to be retained, not for minutes, but for hours; the temperature being kept continuously low, by additions, as circumstances may require. Or the cold may be applied by means of water or ice in bladders. A doubly beneficial result is obtained. The heat and pain are mitigated, and, at the same time, the inflammatory process is held in abeyance; in the slighter cases, it may never occur; in the more severe, its attack will be less violent than it otherwise would have been. Afterwards, it is our principal object to prevent the contact of atmospheric air; the stimulus of which would certainly induce, or aggravate, inflammatory accession. In the slighter cases—those of the first class, and a few of the second—we hope to avert true inflammation altogether, and to obtain cure by resolution, with or without vesication, and certainly without the formation of ulcer or secretion of pus. After discontinuance of the cold, therefore, the part must be protected in some way from without. It may be enveloped carefully in a thick roll of cotton wadding, which is retained by gentle deligation. Or it may be coated by a layer of some bland adhesive substance, which will not irritate the raw or injured surface, and yet will effectually exclude the air; as soap, gum, or varnish. Gum is probably the preferable, as recommended for unclosed wounds (p. 563); it is certainly bland; with ordinary attention can be kept perfectly protective; and has the advantage of permitting the condition of the part to be observed, almost as well as if it were wholly uncovered. Or the part may be dusted over with flour; but, when vesication is expected, this is an objectionable form of protection; inasmuch as the serum bakes it into crusts, which crack, loosen, and are apt to irritate injuriously. Vesicles, when large, are punctured, to permit free escape of their contents; so relieving tension. But especial care is taken not to ruffle or displace the cuticle, which is certainly the best protector of the tender surface beneath. 2. *Calm and restore generally.* The state of depression must be watched in the first instance, and nothing done to favor its continuance. On this account, when a burn or scald involves a large part of the surface, the continuous use of cold cannot with propriety be had recourse to. Under such circumstances, a warm solution of opium, or other anodyne, is preferable, for assuaging pain. When the duration and degree of shock threaten to prove excessive, restoratives must be employed; as heat to the general surface, and warm drinks internally; followed, if need be, by wine, ammonia, or other stimulants. If reaction prove premature and sthenic, it must be moderated by opium or other calmatives. 3. *Keep antiphlogistics in view.* When stimulating to overcome the shock, the coming sthenic reaction must always be remembered. And, while we prevent sinking, we are to be careful not to expedite and aggravate impending inflammation. 4. *Promote separation of the sloughs.* For this, poultice, or warm water-dressing, are the suitable applications. A certain amount of inflammation is essential for detachment, and under these epithems it advances favorably. For the severer burns, cotton, gum, soap, and varnish, are manifestly unsuitable; the first, especially, would speedily become soaked with discharge, and either require frequent renewal, or else prove a very hot-bed of pestilential putrescence. It may happen, occasionally, that the central portion of the eschar is detached at an earlier period than the margins; and pus, accumulating beneath the detached part, does harm to the inflaming and ulcerating textures beneath. Under such circumstances, the elevated and tense dead portion—the least pressure on which produces much pain—is to be freely cut through by a bistoury. 5. *Limit the inflammation.* A certain amount of this is necessary, to separate dead and dying parts from the living, and to originate the subsequent process of granulation. But we desire no more than what is essential. The part is kept at rest, in a suitable posture; and is fomented and poulticed, or enveloped in the water-dressing. Antiphlogistic regimen is enjoined, in moderation. The bowels are kept open, and perhaps antimony is mildly exhibited. In the more urgent cases, a moderate bleeding may be taken from the arm. But all this must be done with caution, sparingly and grudgingly; for we know full well that every available resource of the system will by and by be called upon, during the protracted period of granulation and probable hectic. 6. *Promote granulation.* So soon as inflammation has subsided, the water-dressing is applied; not hot, but tepid, as a mere detergent and protective; and this is continued, so long as the granulating surface remains of a healthy and vigorous character. Such period is but a short one, however; the sore soon assumes the weak character; requiring medication of the dressings, by various stimulants; as the salts of zinc, copper, iron, silver, &c. At the same time, early support by bandaging is usually expedient. By some, a weak solution of the chloride of soda is held in much repute, as an application from the first; but this seems to be its proper place; and, in this place, I can testify from experience to its efficacy. 7. *Moderate contraction.* And remember that centripetal movement of the old textures does not cease on cicatrization (p. 179). The parts implicated in the injury, mediately and immediately, must be placed in their proper relative position; and must be retained so, by suitable retentive means, during the whole period of cure. For example, in burns of the neck with loss of substance, the head must be placed and kept erect by bandaging; otherwise the chin will be drawn down upon the sternum; and frightful deformity will ensue, by traction of the facial integument (Fig. 218). In less extensive injuries, on the face, arms, or other exposed parts, strips of adhesive plaster may be so arranged as to moderate the centripetal movement. This opposition, however, must never be carried so far as to peril the frame, by hectic from tedious cure. When orifices of canals are implicated—as the nares, urethra, rectum—they are to be kept distended by plugs or bougies, until the period of contraction has gone by; in order that the normal calibre may be retained. When opposing surfaces are implicated, as in extensive burn or scald of the fingers, abnormal union is to be prevented by the daily and careful interposition of dressing; and it is well, at the same time, to maintain a considerable pressure at the points of commissure. 8. *Retain the functions of joints.* This is effected by passive and frequent motion. But sometimes, the parts exterior to a joint are so wholly involved by the injury, as to render it obviously impossible to fulfil this indication. The joint must become stiff, by a kind of spurious anchylosis (p. 471). And we have in these cases to content ourselves with securing such a position of the stiffening part, as shall afterwards prove most serviceable; the elbow, bent at right angles; the knee almost straight. 9. *Maintain the powers of the system.* This is done by attention to air, exercise, and clothing; by generous diet; and by the use of tonics and stimuli—of the latter, cantharides is often a most efficient form. A view towards this indication must always pervade our fulfilment of the fifth. 10. *Remedy deformity.* In spite of all efforts to moderate contraction, and to maintain due relation of position, deformity is of frequent occurrence, when much loss of substance has been sustained. A simple incision may sometimes suffice, when the treatment has been negligent. Mere division of a tight cicatrix may permit the parts to be normally readjusted; and then, the proper retentive means being employed, a better healing may be obtained. Or, by means of a subcutaneous wound, a depressed and adherent cicatrix may be set free. But perhaps there has been no faulty treatment; everything has been done to prevent displacement, and yet it has occurred. Or it may be that, to save the system and obtain a cure, the moderating means have been less energetically employed towards the close, than at the first. In short, there

Fig. 218.



Burn of the neck. Deformity caused by contraction of the cicatrix.

has been much loss of substance; and the part could not have healed at all, without very considerable contraction of the old textures. In such cases, the deficiency must be supplied. By incision, the cicatrix is divided; the parts are replaced in their proper position; and then a portion of integument and subcutaneous tissues, of suitable dimensions to occupy the gap, having been detached by incision from the vicinity, is adjusted in its new place, and there retained by sutures and plasters; a connecting slip being left undivided, whereby its vitality is maintained. It adheres, and effectually prevents recontraction; the parts retain their normal position, and the deformity is—at least in some degree—removed. The wound, whence the atoning flap was taken, is brought together, and treated for either adhesion or granulation, according to its form and circumstances. Sometimes the new matter of the cicatrix is unduly prominent. In such a case, it may be brought to its proper level by pressure carefully applied; for, as already observed, such adventitious structure is very amenable to absorption. Should pressure fail, the dense prominence may be excised, and the wound treated on ordinary principles. 11. *Amputate in certain cases.* When a limb is charred throughout its entire thickness, amputation is expedient at once; so soon as the shock of injury has sufficiently passed away, to admit of the operation being safely borne. When a joint has been opened into, or a bone necrosed; or when from any other cause suppuration is profuse, healing slow, and hectic urgent—the part must be sacrificed to save life; and then the amputation is secondary. 12. *Throughout the whole cure, have great regard to the state of the internal organs, especially the lungs; and chiefly during the inflammatory stage.* Also, let it be remembered, that, in the case of extensive burns, the patient never can be reckoned safe until after the whole has been fairly cicatrized. The system may have power enough, by a great and long-protracted struggle, to effect the skinning over; and may then sink, as if exhausted in the effort.

Such are the principles of ordinary surgery, which are suitable to guide us in the treatment of this form of injury. Some strenuously advise stimulating applications from the beginning; and a theory has been made to suit the practice. Neither seem to merit approval. Alcoholic applications may sometimes prove serviceable, on a scalded but unbroken skin. There can be no doubt that, in scalds of the hand or foot, for example, the immediate application of spirits of wine is favorable to subsidence of pain. Also, in the severer injuries any stimulant at first increasing the pain, may afterwards be truly said to deaden it; by accelerating and aggravating inflammation, so as speedily to overcome the impaired vitality, and convert all into one slough. But such is not wise and prudent surgery. In all severe cases, let stimulants, both internally and externally, be retained for their proper time and place; and these will be found in the second, sixth, and ninth, indications of cure.

Kentish, on Burns, Lond. 1797; Earle, Essay on the Means of Lessening the Effects of Fire on the Human Body, Lond. 1799; Kentish, a Second Essay on Burns, Newcastle, 1800; Marjolin et Ollivier (Art. Brulure), Dict. des Sc. Medicales; Dickenson, on Burns and Scalds, Lond. 1818; Dugueron, Dissert. sur les Brulures, Paris, 1830; Dupuytren, Leçons Orales, &c. Paris, 1832; H. Earle, Lectures on Burns, Lond. 1832; Mütter, on the Cure of Deformity after Burns, Philadelphia, 1842.

CHAPTER XX.

EFFECTS OF COLD.

THE effects of intense cold applied to a part, so as greatly to diminish vital power, and not unfrequently to produce local death, more especially when heat or other stimulus is rashly used—constituting what is termed *Frost-bite*—have been already considered (p. 242).

The term *Chilblain* is applied to a less evil; the effects of cold, as affecting chiefly the surface. The parts most liable so to suffer, are those which not only are habitually exposed to cold, but likewise are naturally of comparatively weak circulation, and consequently of low power; as the fingers and hands; the toes, feet, heels, and ankles; the tips of the nose and ear. And these are most especially liable, when extreme circulation in the individual is naturally imperfect; from dyspepsia, or other disease, or from original conformation. Like frost-bite, chilblain is usually the secondary effect of cold; caused by premature restoration of heat and circulation; and the result, usually, of repeated exposure and alternations of temperature. Reaction is excessive, with diminished power of control. Yet a high degree of over-excitement does not ensue; otherwise gangrene would inevitably result, and the case be termed one of frost-bite. Either a congestion, or chronic inflammatory process is established. An unpleasant sensation of heat is complained of, often attended or followed by an intolerable itching. The part swells, and becomes of a dark red hue. No further progress may be made, the part remaining in this congested state for a long period; not advancing to higher vascular results, and but little disposed to recede. But, very frequently, vesicles form; and these do not dry and desquamate in the ordinary manner; but, having given way, disclose a very painful ulcer beneath, emitting a thin watery discharge, slow to heal, and prone to assume either the irritable or indolent characters; often at first irritable, and secondarily indolent. Or, instead of vesication, the surface seems to crack; and the fissures degenerate into ulcers of a similar kind. Usually, the ulceration is but superficial; occasionally, however, it extends deeply, involving tendons, and even more hidden parts. In some cases, vitality is wholly overborne, and gangrene supervenes.

Prevention is better than cure; by avoiding exposure to extreme cold, more especially in the parts most liable to suffer. Using for the purposes of ordinary ablution lukewarm water; neither cold nor hot. And, when exposure has been incurred, taking care that reaction is gradual and safe; using, for this purpose, the means recommended in the case of threatened frost-bite (p. 251.)

When the congestive state has been induced, probably the best remedy is nitrate of silver, applied so as to blacken the integument; carefully avoiding vesication. For the ulcer and fissures, at their early and irritable period, nitrate of silver in substance is suitable; followed by light poultice or water-dressing. When they have become weak or indolent, as they tend soon to do, various stimulant applications are required, along with uniform support by careful bandaging. A bandage carelessly applied, so as to cause partial constriction, would certainly be productive of very serious injury to a part whose vital power remains so long and so much impaired. Occasionally, amputation of a finger or toe may be demanded; ulceration having extended deeply, bones having become diseased, or gangrene having supervened.

When the whole frame is exposed to intense cold, the general powers of life gradually cease. The patient grows feeble and languid, inclines greatly to sleep, sleeps, becomes comatose, and dies. On dissection, there is usually found considerable serous effusion within the cranium. To prevent the extreme sedative result, the mind must be made to work against the body. Sleep and lying down must be resisted, wakefulness and bodily exertion compelled. To restore, the same gradual appliances must be used as in regard to a part; cold friction; gradual increase of the temperature; and very sparing administration of food, drink, and other stimulants, internally; otherwise, what may be termed universal gangrene, by over-excitement affecting the whole frame, will certainly ensue.

Thomson, Lectures on Inflammation (Art. Frost-bite), Lond. 1813; Desmoulins, de la Gangrene par Congelation, Paris, 1815; Mornay, sur la Gangrene des Extremités par Congelation, Strasbourg, 1816; Larrey, Mem. de Chir. Milit. vol. iii; also Capt. Cook's Voyages, vol. ii.

CHAPTER XXI.

OF FRACTURE.

FRACTURE, or solution of continuity in bone, is usually the result of external violence; sometimes it is effected by muscular action alone. And this, too, is not a mere local casualty; but apt to be followed by inflammation, suppuration, gangrene, erysipelas—bringing life into the greatest danger.

Various terms are employed to designate the kind and circumstances of the injury. It is called transverse, oblique, or longitudinal, according to the direction in which the break has occurred. It is said to be *Simple* when there is a mere fracture of the bone, at one part; and nothing more. *Compound*, when in addition to the injury of bone, there is an open wound of the superimposed soft parts, communicating with the fracture. *Comminuted*, when the breaking is not at one point but at many; occasioning numerous fragments. It is said to be a case of *Fracture with wound*, when the coexistent wound of the soft parts is at a different place, and does not communicate with the injury of the bone.

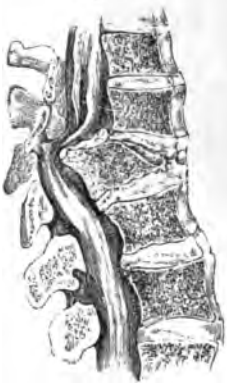
The parts of the skeleton most liable to fracture, are the long bones, more especially of the extremities; and these may suffer by violence applied either directly or indirectly. The flat bones, with the exception of those of the cranium, are less liable; and seldom give way except under violence which is both direct and severe.

A bone does not always break at the point struck. A blow on the symphysis menti often occasions fracture of the jaw, near its angle; a concussion applied to the bones of the leg, through the foot, ordinarily produces fracture of the tibia, near the ankle, and of the fibula at its upper part.

The broken fragments usually become more or less displaced. The force wherewith the injury was inflicted may push one or both aside; and the weight of the limb may increase displacement, when the part is raised, or when an attempt is made to use it. But the paramount displacing agent is the action of those muscles which are implicated in the injury. Sometimes there is retraction of the fragments, and elongation of the part; as in transverse fracture of the patella. Most frequently, the fragments cross and overlap each other, with consequent shortening of the limb. Sometimes one fragment alone is displaced; as in fracture of the clavicle; the sternal portion remaining nearly *in situ*, while the lower passes downwards and forwards. In other cases, both suffer displacement; as in fracture of the humerus below its bicipital groove; the upper fragment passing in towards the chest; the lower being elevatc and displaced outwards, by the deltoid.

One fragment usually is on a higher level than the other, seeming : if it had risen above its fellow; and hence we frequently speak of "tl rising end of the bone." But this phrase, if not rightly understoo may lead to great practical error. The sternal end of the fractur clavicle seems to rise, but in truth is in its place; while the lower fra ment has fallen away. And in attempting readjustment, we are not repress the apparently "rising end;" but, leaving it alone, we bring t to its level the one which is truly displaced. On the other hand, tl "rising end" may be not more apparent than real; as in fracture of tl tibia, below its tubercle; and in fracture of the femur, below the tr chanter minor. In each of these cases, the upper fragment is tru tilted forwards; and means for its reduction are undertaken with pr priety.

Fig. 219.



Fractured spine, bisected; showing the formidable and fatal injury inflicted on the cord.

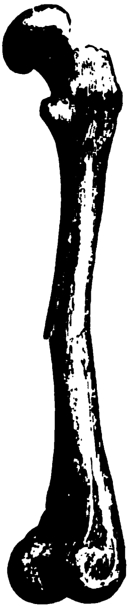
By the displacement, neighboring parts are liable to be compresse torn, or otherwise injured; and hence the mo serious consequences may ensue; unless such d placement be detected, understood, and speedi rectified. For example, the displaced fragmen of a broken rib may puncture and irritate tl pleura and lungs, exciting violent inflammati there. And displaced portions of a broken cr nium may cause a like injury to the brain and i membranes, followed by results still more disa trous.

Proneness to fracture varies with age. Tl bones of the old man are brittle, and give wa under amounts of violence which would have li tle disturbed them in younger years. The bon of the child, on the contrary, are fully as like to bend as to break; although, indeed, it is tr that fracture takes place in utero.

Bending of the long bones, with partial fra ture from force applied to their extremity, is by n means uncommon in the child and adolescent. The bones of the for arm, for example, are not unfrequently found more or less curved, fro a fall saved on the hand. Continuity is plainly uninterrupted, and ben ing is apparent; there are much pain, deformity, and loss of power, b no crepitus; the bending can be undone, by force suitably applied; aı then, for the first time, obscure crepitus can be perceived. A few of tl osseous fibres had given away, on the convexity of the curve; and thes not being brought into apposition, could give no crepitus until the bo was made straight. In other cases, bending is unaccompanied with aı solution of continuity. For example, a child may receive a smart bl on the head; depression of the cranium may be so occasioned, witho any fracture; and the depressed portion, by the innate and gradual re lience of the osseous tissue at that age, ultimately resumes its norm relative position.

Constitutional vice often predisposes to fracture. The cancerous di thesis does so, as we have already seen (p. 285); and still more, that abnormal condition of the skeleton denoted by the term "fragilitas ossium" (p. 408). It is a common saying that, in frost, the bones are more brittle than at other times; but, probably, the frequency of fractures then can be more rationally accounted for, by the increased liability to fall, and by the hardness of the ground on which the falling body is received. The functions of certain bones predispose to their fracture; the clavicle, supporting the shoulder, is rendered liable to fracture by blows or falls on that part; and the radius is similarly circumstanced, when compared with its companion the ulna, in consequence of its special connection with the hand. Others, again, are rendered liable by the mere exposure of their position. The unprotected cranium, for example, is more liable to fracture than the comparatively well-cushioned scapula; the clavicle is more liable than the ribs; and any of these is more liable than the spine.

Fig. 220.



Partial fracture, with bending of the femur.

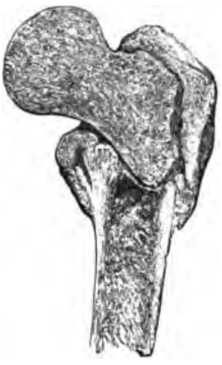
While such circumstances may be said to be the predisposing causes of fracture, the exciting causes are two: external force and muscular action. Force may be applied directly; as by a blow, or by a heavy weight passing over the part. Or it may be indirect; as when the clavicle breaks from violence received on the shoulder; or the fibula, near its head, from a shock sustained on the foot. Again, disruption of a bone may be effected by muscular agency alone; as when the patella, or olecranon, is snapped across, during an intense and sudden muscular effort; or when the radius gives way under attempted feats of strength, as is not uncommon.

The *Symptoms* of fracture are usually very plain. There is obvious deformity of the part; and its muscular power is all but lost. A fractured arm, for example, is swollen, and out of drawing; and the patient is unable to move it, without the assistance of the corresponding member. Sometimes, as in the case of the patella, the part is elongated; much more frequently it is shortened; the lower extremity, in fracture at the hip, may be abbreviated to the extent of two inches or more. Voluntary motion is much abridged; in many cases, the patient, of himself, can move the injured limb little if at all. Involuntary motion, on the other hand, is much extended; that is to say, the surgeon can, though not without inflicting much pain, move the limb in directions and to an extent of which it was previously incapable. And, at the site of fracture, the slightest examination usually makes it abundantly plain that the part is remarkably and preternaturally mobile. Pain is great and constant; and ever and anon liable to sudden exacerbation, from spasmodic twitchings of the muscles implicated in the injury, whereby the bones are displaced anew, and the soft parts irritated and torn. If either fragment come in contact with nervous trunks, compressing, puncturing, or in any way irritating these, the pain is likely to prove extreme. Swelling invariably occurs, and is of three kinds. 1. The displacement and overlapping of the fractured ends produce a greater or less enlargement of the part, immediately after infliction of the injury. And if muscles be relaxed by the displacement, the bulging into which they are consequently thrown will contribute to the immediate swelling. 2. The first swelling is increased by extravasation of blood; which inevitably follows solution of continuity in the bone, and coexistent laceration of the soft parts. If any considerable vessels have been injured, this kind of swelling may prove very great; partly by blood accumulating around the fracture, partly by its being infiltrated into the surrounding tissues. 3. The second swelling, in its turn, is followed and modified by that which attends on the inflammatory process; beginning to form after the lapse of some hours. The tissues then become infiltrated; partly by serum, partly by fibrinous exudation.

But the peculiar and diagnostic sign of fracture, is what is termed *Crepitus*; a sensation of rubbing, grating, and crackling, which is imparted to both hand and ear, when the fragments are moved one upon the other, with contact of their broken surfaces. When there is no great displacement, the fractured ends remaining partly in apposition, this crepitus may be felt on the slightest movement of the limb; and, often, both the patient and his attendant are made very plainly aware of its existence, by the involuntary movements which spasm of the muscles from time to time occasions. But when the fracture is transverse, the displacement great, and the fragments completely overlapping, crepitus is not so easily found. Reduction must be effected, in the first instance; in order that the broken surfaces may be brought in contact with each other; and then, by movement, the desired sign will be plainly enough emitted. In fracture of the neck of the femur, for example, rotation of the limb will be quite unattended with crepitus, so long as the lower fragment is retracted, and lodged on the brim of the acetabulum, free from the head of the bone; but, so soon as, by gentle extension, normal length of the limb has been restored, crepitus will be produced by but very slight movement.

Certain fractures, termed *Impacted*, rarely afford crepitus. One fragment is driven into and lodged in the cancellous textures of the other, by the same violence which caused the fracture; and so the bone is scarcely broken, when it again becomes fixed, with its continuity apparently restored. There is little deformity, no unnatural mobility, and usually no distinct crepitus under ordinary manipulation. Examples of this form of injury are found, in fracture of the distal extremity of the radius, and at the trochanteric portion of the femur.

Fig. 221.



Impacted fracture, through the trochanters. The upper fragment is wedged into the lower.

The manipulations necessary to ascertain the nature of an accident, and which are especially directed towards detection of crepitus, are to be conducted with all gentleness; so as not to produce unnecessary pain, or endanger further injury to the soft parts, with aggravation of subsequent inflammatory excitement; and yet with determination, sufficient for fully satisfying the examiner as to diagnosis. It is much better that one thorough examination should be made at once, painful though it be, than that more gentle movements and inquiries should be made, with frequent repetition; delaying the means of cure. Also, let it be borne in mind that, at whatever cost of suffering to the patient, it is our paramount duty to make such a thorough examination; for two reasons. In the first place, in order that the required repose and treatment of the part may be immediately instituted; in the second place, and mainly, that error of diagnosis may be avoided. For, suppose that in the hip insufficient examination has led to the latter event; that a fracture is believed to exist, while in truth the injury is dislocation. The ordinary treatment for fracture is applied, and continued for the usual period. On finally undoing the retentive apparatus, the true nature of the case may be for the first time disclosed; too late to remedy the evil. The patient remains a cripple for life; and an untoward event has happened to the surgeon's welfare and reputation.

Anæsthesia is of great advantage here; especially in the young, and in those who from any cause are intolerant of manipulation. They are saved all suffering; and the surgeon, undistracted, and in quiet leisure, deliberately satisfies himself as to the condition of every part—all the more readily and accurately because the muscles are rendered pliant and unresisting.

The required examination may usually be conducted thus. The patient having been arranged in a suitable posture, the distal extremity of the injured bone is taken hold of by the surgeon's right hand, while his left is placed over the seat of injury. With the right hand, the limb is gently extended, till normal length is nearly or altogether restored; then, while extension is maintained, gentle rotation is made; and the fingers of the left hand are used coaptatingly, so as to force the broken fragments—if such there be—to rub on each other, and emit the expected crepitus. At the same time, by another sign it is made apparent that solution of continuity exists in the shaft of the bone; the lower fragment being found to roll in obedience to rotating movements of the manipulator, while the upper, just as plainly, is unaffected thereby.

It is obviously of much importance, that such examination should be made at as early a period as possible; before spastic rigidity of the implicated muscles has occurred, which might oppose the required extension and coaptation (if anæsthesia be not employed); and before concealment of the relative position of the parts has taken place, either by the blood of extravasation, or by the exudation of the inflammatory process.

The *Prognosis* varies, 1. According to age. In the young, the process of reparation is usually both more rapid and efficient than in advanced years; also, the system is less liable to suffer by the accidents of injury, and by the confinement which its treatment may require. 2. According to the site of the break. Fracture of a long bone, near its middle, is less important than a similar injury which implicates the articulating end. Fracture of a slight and superficial bone, as the clavicle, is less likely to prove troublesome than similar injury of one which is large and thickly covered, as the femur. Fracture of the neck of the femur, within the capsular ligament, is but little capable of satisfactory union; while a more severe amount of injury, immediately exterior, through the trochanters, unites readily. Fracture of the scapula is seldom troublesome, either at the time or subsequently; fractures of the cranium, pelvis, and spine, are invariably fraught with the utmost danger. 3. According to the nature of the fracture. The Compound is obviously more hazardous than the Simple solution of continuity; the Comminuted, and the Fracture with Wound, are more likely to prove troublesome than the fracture which is in all respects Simple. 4. According to the state of system. The patient in ordinary health is most likely to advance favorably in cure, than one who is either debilitated by privation or disease, or plethoric and prone to undue excitement. Also, the patient affected by any constitutional vice, which favors occurrence of fracture, is obviously situated unfavorably as to cure. And again, it is often found that the pregnant female has a slower union of fracture, than would otherwise happen; the nutritive powers of the system seeming to be almost wholly devoted to the exalted uterine function.

The mode of union, or preparative process, is a subject of much importance; on the right understanding of which the indications of treatment depend. It may be conveniently divided into the following stages; understanding that the fragments have been duly readjusted, and are so retained. 1. Blood is extravasated at the site of fracture; and, accumulating, distends the surrounding parts into a kind of pouch, in which the fractured ends are laid; and the cavity of this pouch is occupied by the extravasated blood, partly fluid, partly coagulated. The surrounding parts are condensed; and, obeying the stimulus of the injury and displacement, become more energetic in their circulation—prepared for the unusual effort in nutrition which is about to be demanded of them. 2. The extravasated blood is absorbed; and the ends of the fractured bone also undergo alterations, being deprived of their earthy matter to a great extent, and so prepared for higher efforts as a vascular tissue. Liquor sanguinis is exuded from the parietes of the pouch, from the ends of the bones, and from the periosteum which invests them; and this plasma assumes the position which the blood occupied. The pouch, however, has somewhat contracted from its first dimensions, by tumescence of the parietes—favored, or at least permitted, by gradually decreasing extravasation. It has been a source of hot dispute, to determine from what tissue this plasma proceeds. Probably it is the offspring of every tissue implicated; exuded from bone and from periosteum, and also from the textures constituting the parietes of the containing pouch, whether these be muscular, fibrous, fatty, or areolar. Perhaps, it may be held enough for the practical inquirer, that there is the plasma, come whence it may. The plasma, having been exuded, consolidates; its serous portion is absorbed; the fibrin remains, and becomes organized. And this organizing plasma not only occupies the pouch, but is also situate between the fractured ends of the bone, and in their interior. At the same time, fibrinous exudation is taking place in the soft tissues exterior to the pouch, whereby they are still further condensed. A portion of this is imperfectly organized; and remains for a time—sometimes of considerable duration. The rest is absorbed, previous to organization, on subsidence of the vascular excitement by which it was exuded. That is a part of the inflammatory process; but only a part. It never rises higher than active congestion; otherwise the process of repair would be arrested and undone (p. 121). 3. The period of plastic exudation may be said to have passed, after eight or ten days. Then the process of organization advances. The plasma sometimes passes into the transition state of fibrous tissue; at others into fibro-cartilage, or even true cartilage. The first of these is most common in the human subject; the last rare, but on the other hand common in many of the lower animals.[1] 4. The organized and transitional mass contracts, by interstitial absorption; increases in density; and gradually passes into the condition of bone. At the same time, the surrounding parts, where immediately in contact with the ossifying mass, are more and more condensed; they become continuous with the ruptured and engorged periosteum; and assume the general characters of that tissue, as well as its function of investing and administering to bone. 5. Ossification advances, from the periphery. The most exterior part of the plasma is the first ossified; and thence ossification gradually approaches the interior. In obedience to the law formerly noticed (p. 175), the first act in this process would seem to be that of the

Fig. 222.

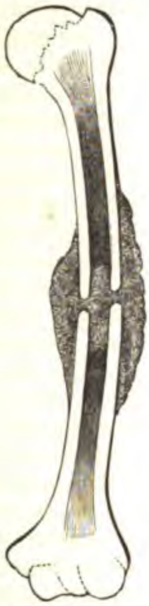


Fig. 223.

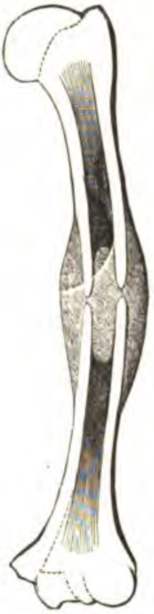


Fig. 224.

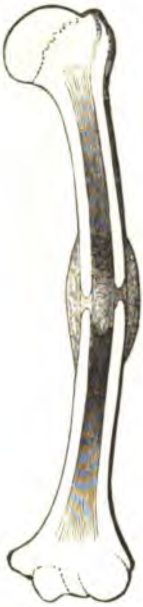


Fig. 222. Fracture of humerus; recent. The pouch of blood shown; the ends of the bones beginning to round off. Fig. 223. The ends of the bones more tapering. Plasma occupies the place of the extravasated blood. Fig. 224. Organization advanced in the callus; and the bulk of this diminishing. Continuity of the bone apparently restored, by the tight embrace of the ferrule. Definitive callus in formation. These diagrams imaginary, and designedly rough.

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[1] See on this subject—Paget on Repair and Reproduction, Med. Gazette, 1849.

parent bone. Nodules of new osseous matter form on it, where in contact with the ruptured periosteum—the rough extremities at the same time undergoing an opposite change; parting with a large share of their original earthy matter, as already stated. These nodules would seem to constitute the nucleus or base of the new bony structure; and are found on each fragment, and on its every aspect. From these nuclei the ossification advances, and a case of bone forms on the exterior of the plasma; advancing from each fragment, and meeting near the centre of the space; the ossification begun by the original bone, continued and maintained by the soft parts—first by the original periosteum, and then by the ordinary tissues, which by condensation and other change of structure, have come to assume not only the appearance, but the function of the investing membrane of bone. Where the original periosteum is deficient, there is no corresponding hiatus in the new bone, as in the case of necrosis (p. 396); for the ordinary soft tissues are not in a state of true inflammation, and all their exudation is plastic. As ossification advances, the mass contracts more and more; ultimately forming a firm osseous ferrule, by which the fractured ends are tightly clasped; and the continuity of the bone is apparently restored. This ossified mass is termed the *Provisional callus*. And the period of its formation averages from four to six weeks. At the end of this time, the bone feels firm; for the fractured ends are tightly held together by the ferrule. It is probable, however, that between the fractured ends ossification may not yet be completely accomplished. 6. The *Definitive callus* is that which is formed between the ends of the bone, and which constitutes the final medium of incorporation of the ends. Its organization and ossification are accomplished by a more slow and gradual process than that of the provisional callus; apparently in obedience to the general law, that whatever is destined for an enduring existence, is constructed leisurely and well. By the definitive callus, the ends are firmly glued together; and the fracture is truly united. In proportion as construction of definitive callus advances, the provisional gradually diminishes by absorption; the latter being merely subservient to the former. The provisional callus, indeed, may be termed Nature's splint; whereby the parts are kept in close and undisturbed contact, until their real consolidation shall have been completed. When this has been achieved by definitive callus, all necessity for the presence of provisional callus has gone by; and

Fig. 225.

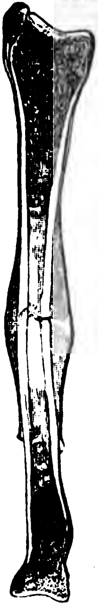


Fig. 226.

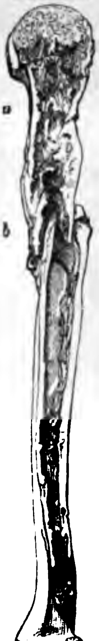


Fig. 225. Fractured tibia, bisected; showing the reparative deposit beneath the periosteum. Fig. 226. Section of humerus, showing double fracture united. At *a*, though there is still some preternatural density, continuity of texture is almost completely restored. At *b*, where coaptation has not been so accurate, absorption is busy in accomplishing the same end; the projecting dense laminæ being gradually converted into cancellous texture.

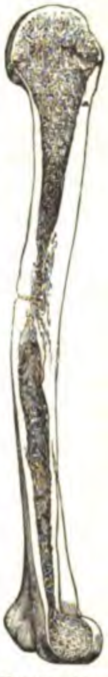
consequently it is soon thereafter removed by absorption. At the same time, absorption is also busy with the exudation and temporary change of structure in the soft parts; restoring these nearly, or altogether, to their normal state. The repair in the main structure having been completed, the exterior scaffolding whereby that repair had been effected is taken away. And thus not only is the bone firmly and truly reunited, but the symmetry and usefulness of the part are also restored. This gradual change is seldom completed in less than many weeks; and, in some cases, even a very long period is required. 7. The definitive callus is at first preternaturally dense and compact; but is gradually modified by absorption; and, ultimately, is so changed as to render continuity of the normal texture of the bone complete. On making a section of recently united bone, a dense compact mass of new osseous matter is found intersecting the cancellous texture, at the site of fracture; but, after a few years, section discloses that part of the bone's interior perhaps a little more dense than elsewhere, yet open, and quite of the cancellated character. And thus it would seem that not even the definitive callus can be said to be truly permanent. On the contrary, all callus is temporary; it has a certain duty to perform; and, that having been achieved, it is taken away more or less gradually by absorption.

It appears from the observations of Mr. Paget, on this subject, that in a well-managed fracture in the human subject, the formation of provisional callus is generally reduced to a minimum; the exudation being thrown out almost entirely between the fractured ends, and Nature's splint being in great part superseded by that of the surgeon. But in bones which cannot be kept completely at rest by mechanical means (as the ribs and clavicle), provisional callus occurs in considerable quantity; as it does also in the bones of animals, from the consideration of which our ideas on this subject are mainly derived.[1] And when, in man, the fractured ends have not been duly adjusted, but left overlapping, there is not only an unusual amount of callus thrown out, but a certain quantity is necessarily also of a permanent nature; it being impossible, otherwise, to effect and maintain efficient consolidation of the fracture.

In bending with partial fracture of the long bones, repair takes place as in complete fracture.

Practically, it is important to remember, that provisional callus remains to a certain extent soft and pliable, during the first few weeks of its existence; not so yielding as to admit of motion between the fractured ends, under ordinary circumstances; yet pliable enough to admit of mal-adjustment being gradually rectified, by pressure duly applied; also pliable enough to permit serious and untoward bending, if the functions of the part be too soon and too freely resumed. A broken leg must be warily used,

Fig. 227.



Humerus bisected; showing reparation after partial fracture. Unusual density at the injured part; but absorption busy in restoring the cancellous portion.

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[1] Paget, loc. cit.

for some considerable time after apparent consolidation; and a broken bone, anywhere, may have its contour remedied, if need be, by suitable pressure—applied even after the process of reparation seems to have been completed.

In some fractures, as in that affecting the neck of the femur, within the capsule, there is no opportunity for the formation of provisional callus. The recipient pouch cannot be made; and there are no surrounding textures to supply the required plasma. And this is a main reason why union at that part is so difficult and rare; the latter and more tedious half of the process only being obtained. In like manner, the flat bones, more especially the cranium, have a deficiency of provisional callus. And it is well that such is the all-wise arrangement. For, were a cranial fracture to unite through the aid of a bulging hard matter on each aspect, the functions of the brain would assuredly be interfered with to a dangerous extent. In these bones, reunion is by definitive callus alone; and this if the intervening space be not great, very efficiently repairs the breach; usually at no distant period. Should, however, the hiatus between the fragments be at all considerable, osseous reproduction is incomplete; it advances only a certain way; and the remainder of the plasma is converted into a dense fibrous substance.

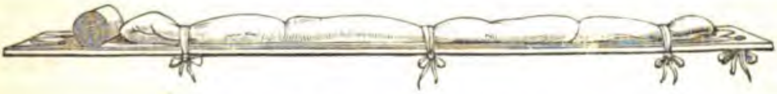
Sometimes this fibrous reunion is desirable rather than otherwise; as in the case of the patella. If the ligament be short, it is very efficient; and less liable than new bone to yield, under reapplication of violence. It may either remain ever of the fibrous character, only increasing in density; or it may gradually become ossified, as in the case of deficiency in the cranium.

Treatment of Fracture.

This may be said to consist of three parts:—*Reducing* the fragments to their proper position; *Retaining* them so; and *Preventing* re-displacement, or other evil consequences. *Reduction* is effected without force, and gradually. With one hand, the limb is grasped on the distal aspect of the fracture, and extension made gently yet determinedly; the limb being at the same time placed in such a position, as to insure relaxation of those muscles most likely to oppose this movement. For example, in fracture at the ankle, the leg is to be placed in a flexed posture, to relax the gastrocnemii; otherwise, much difficulty may be encountered, and the use of injurious force rendered necessary. With the other hand, counter-extension and coaptating movements are made; whereby the fractured ends, which by extension have been brought to the same level, are placed in immediate and accurate contact. This constitutes reduction. The limb is then laid down gently on the bed or couch; and the hands retain this normal arrangement of the part, until retentive apparatus shall have been applied. At one time, it was proposed to delay reduction until the inflammatory stage had passed; leaving the part meanwhile almost unconfined, and using fomentation and poultice. But it is very obvious, that the jerking of the limb, and other movements, voluntary and involuntary, to which it must be subject, will maintain and aggravate the dreaded affection; and the sure way to avoid this is to reduce at once, ere yet swelling by any kind of effusion, or spastic rigidity of the implicated muscles, have had an opportunity of opposing extension. Thus no unnecessary and additional injury is done to the soft parts; either by continued jerking movements of the spiculated ends of the bones, in consequence of coaptation not having been effected; or by employment of force in extension, when adjustment is at length desired. Moreover, the most obvious cause of continued excitement is at once removed. If anæsthesia be employed, reduction will not only be rendered painless, but also more easily accomplished.

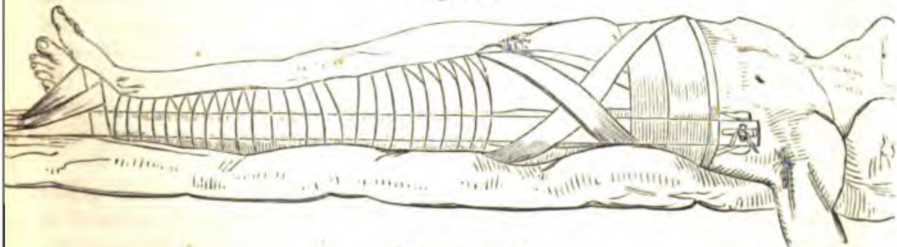
Retention is effected by the fulfilment of two obvious indications. First, by keeping the limb in such a posture, as shall relax those muscles which we know to be the most busy and powerful agents of displacement. Secondly, by applying mechanical means, externally, to the fractured part; adapted to prevent motion. These mechanical appliances are termed *Splints*. They are variously constructed, but all with one object in view—to rest lightly and easily on the part, and yet be successful opponents of motion in the fragments. They may be made of iron; as the double inclined plane, so useful in most fractures of the leg. Or of wood; as the ordinary splint for fractured femur, and fractured fibula. Or of pasteboard; as in fracture of the bones of the forearm. Or of leather; like the splints found so useful in chronic affections of the joints. Or of soft materials saturated with gum or starch, which become tightly adherent as well as accurately fashioned to the part. The wood, iron, and pasteboard splints are those most commonly in use, and most generally applicable. They are retained by bandaging, uniformly and evenly applied; not so slack, as to admit of any motion between the fractured ends; and not so tight, as to endanger undue pressure or constriction, either on any part or on the whole limb. The first application of the bandage should always be rather too slack than otherwise; allowance being made for swelling and engorgement, which are certain to occur,

Fig. 228.



Splint, ready for application. The long splint in use for fractures high in the thigh.

Fig. 229.



The splint applied.

to a greater or less extent, in the course of a few hours. The splints should invariably be of sufficient length to command the neighboring joint or joints; otherwise, by rotation, voluntary or involuntary, redisplacement will certainly be effected. In fracture of the radius, for example, unless the wrist be completely commanded, pronation will occur; inevitably causing displacement, ill-adapted callus, and a weak as well as unseemly limb. A short splint, extending a little above and below the fracture only, has been well characterized by Mr. Pott, as "not only an absurdity, but a mischievous absurdity." In order to protect the integument from being chafed by the splints, they are lined suitably; with fine tow, or cotton wadding, or soft flannel, or linen; or—especially in hospital practice—the larger splints may be furnished with small mattresses, stuffed with chaff or bran; the protecting cushion being most used where pressure is likely to be greatest, and where chafing consequently is probable.

Splints and bandaging having been duly applied, the limb is placed in a comfortable and suitable posture, and so retained; relaxation of the displacing muscles never being forgotten. A pillow, if need be, may be adjusted beneath the part. But the general mattress or couch, on which the patient is laid, should be rather hard than otherwise; more especially in fractures of the spine and lower extremities, in order that a tolerably uniform level may be maintained. When the double inclined plane is used for the lower limb, this indication may be further fulfilled, by placing a flat board below the lower part of the splint. After due adjustment, the parts cannot be too little disturbed. Should the bandage become tight, from inordinate swelling of the limb, and pain be complained of; should an involuntary movement have obviously caused redisplacement; or should subsidence of swelling, or restlessness of the patient, or both, have slackened the bandage—permitting too great a latitude of motion between the fractured ends—the retentive apparatus undoubtedly ought to be reapplied; but not unless. The "nimia diligentia" of surgery is bad in wounds; it is worse in fractures. Daily dressing, movement, and manipulation, may, in the eyes of the ignorant, express great care and anxiety, and even skill, on the part of the practitioner; but, in the mind of the well-informed, the same evidence convicts him of glaring misconduct. It is most essential for due advancement of the process of reparation, that the uniting parts should be placed and retained in a state of absolute repose. Watchfulness and meddling are widely distinct. We cannot satisfy ourselves too often—from examination both by sight and touch, and also by regard to the general state of the system—that all is advancing favorably at the site of fracture; but at the same time, we cannot too seldom interfere with the position of the limb—when this continues accurate and easy.

A proposal has recently been made to supersede almost all other splints, by those of gum or starch. Pledgets with bandaging, soaked in starch or gum, are applied so as to envelope the whole limb accurately; in the same way, and to the same extent, as ordinary retentive apparatus. But it is necessary to continue extension; until the apparatus has become dry and hard. It is of easy adaptation, looks well when in position, and is promising of much benefit; forming a tight, accurately fitting, unyielding case, in which the broken bone lies securely imbedded. And under certain circumstances, its use is in all respects admirable. During the first period of the treatment of severe fractures, however, the application of it in mass is quite unsuitable; for considerable swelling must occur, requiring proportionate slackening of retentive apparatus, which ought consequently to be light, and easily changed. Further on in the case, when swelling has reached its acmé and has begun to subside, it is still inappropriate; if applied to-day, the limb may have shrunk by to-morrow, so that the apparatus has ceased to be retentive. But when the time for inflammatory swelling has gone by, and when further decrease of the more or less swollen limb is improbable—then, the permanent, fixed, and unyielding nature of the application ceases to be deterimental, and becomes most salutary. If used sooner—and by many it is now used in most cases of simple fracture of the limbs from the very first—it ought not to be in mass, but after bisection; so that the apparatus then comes to resemble two neatly and closely fitting splints of the ordinary kind. And in order still further to obviate the chance of strangulation, the splinted limb may be incased in a sleeve or stocking of elastic material, instead of the ordinary bandaging.

In the case of an obstinately "rising end" of a bone, it may come to be a question, whether or not pressure should be employed, as by compress and bandaging, to force it into its normal position. In general, this question is to be answered in the negative. The pressure, unless very severe, is not likely to succeed; even when severe, it may fail; and it is apt to occasion ulceration or sloughing of the integuments, or abscess more deeply seated; events all most unfavorable to the process of cure. It is better, by attention to position, to relax the muscles which are causing displacement; and to bring the other fragment higher in its level, until a smooth and continuous adjustment shall have been thus attained. Most certainly, when the rising of the end is only apparent, and not real, as in the case of the clavicle, nothing can be more unwarrantable than the application of pressure to the part which is in truth not displaced.

Occasionally it is found very difficult, notwithstanding every care, to keep the bones in apposition; muscular action being constantly at fault. Under such circumstances, it has been proposed, and not unreasonably, to have recourse to tenotomy. For example, in fractures of the leg, which may not otherwise be kept duly arranged, subcutaneous division of the tendo Achillis may be practised; with immediate and decided advantage, as regards the fracture, and with impunity as regards any ulterior result.

In most examples of fracture, extension is with propriety discontinued, so soon as retentive apparatus has been duly applied. But, in some cases, continuance of a certain amount of extension is necessary; otherwise, by involuntary muscular action, the fragments will again be made to overlap, and the limb will become shortened and deformed. In fracture of the thigh, for example, maintenance of permanent extension is, on this account, essential; and is usually effected by means of the long splint, acted on by a band attached to its upper extremity, and passed
r the perineum (Fig. 229, *a*); by the tightening of which band, the

splint, and the limb with which it has become as it were incorporated, are pushed steadily downwards. Or the same indication may be fulfilled, by suspension of a weight to the distal extremity of the limb.

In some cases, no splints are required; coaptation being both effected and maintained by mere relaxation of muscles, and attention to position; as in fractures of the clavicle and patella.

Prevention is best achieved, by duly carrying out the just principles of retention; keeping the fragments rightly adjusted, preventing motion, and taking care that bandaging is never too tight at any part of the limb. The limb, it has been stated, is to be kept in a posture favorable to muscular relaxation, and consequently conducive to the feeling of comfort. Besides, it should be placed so as to favor venous return, while an opposite influence is exercised towards arterial influx; the forearm, for example, is slung, with the hand raised; and the lower limb is kept on the same level as the rest of the body, with the foot elevated. Undue motion, and over excitement, are the great opponents of union; and either is quite sufficient to prevent it wholly. Inflammation having occurred, exudation is aplastic, the pouch becomes that of an abscess, an opening is necessary, the case becomes compound, and cure may be indefinitely delayed. During the first few days, it is consequently our object to watch the indications of local excitement; and to take every precautionary means in our power, to prevent its excessive advancement. At the first, we have contributed much towards the object in view, by gently, yet at once, effecting reduction and maintaining it undisturbed; the main cause of inflammation has thus been taken away—and that timeously. Diet is low, yet not strictly antiphlogistic; unless suspicious symptoms arise. The bowels are regulated; but purgatives are never expedient, the manifold motion which they necessarily occasion tending to much injury. In hospitals, the fracture bed is useful, by permitting evacuation of the bowels without movement of the limb. If sensations of heat, pain, and throbbing occur in the part, with restlessness, flushing of the face, and acceleration of pulse, blood may be taken from the arm, in the robust and healthy; antimony or aconite is administered, and diet is brought down to the strictly antiphlogistic scale. And antiphlogistics will be especially active, and early, in those cases in which fracture is in the near vicinity of important parts; as in the case of the ribs and calvarium. If there be much involuntary spasm of the implicated muscles, jarring the fragments, opiates are useful. If the signs of inflammation are distinct and advancing, notwithstanding the ordinary precautions, the retentive apparatus must be undone, and discontinued at the part; to admit of leeches and fomentation. But this casualty is of rare occurrence, in the simple fracture, whose ordinary treatment is duly conducted. Should abscess form, it must receive the common treatment; an early and dependent opening.

After the first eight or ten days, the risk of inflammation may, under ordinary circumstances, be said to be past. Diet, accordingly, is gradually improved; for it is essential to maintain considerable vigor in the frame, in order to obtain a due and early completion of the process of union. And this ulterior necessity should never be lost sight of, in the earlier part of the case; more especially when antiphlogistics have unfortunately become expedient.

The retentive apparatus is undone and reapplied, as seldom as possible. At each change, the condition of the fracture should be carefully observed; more especially as regards accuracy of adjustment. If the survey prove satisfactory, the apparatus is simply reapplied as at first. If distortion exist, the splints and bandaging are to be so arranged as to obviate this; gradually restoring the normal position.

At the end of the fourth or fifth week—sooner in the young and healthy, later in those of advanced years and debilitated frame—union to a certain extent, by soft and new-formed bone, has occurred; and our substitutes may be discontinued. If any œdema exist, in the distal extremity of the limb—as sometimes happens, notwithstanding all our care to the contrary—friction is to be employed, with continuance of the bandage, uniformly applied. But, so soon as œdema has gone, let all bandaging be thrown aside; otherwise atrophy and permanent debility of the limb may ensue. The joints, by friction and passive motion, are then gradually brought back to their accustomed freedom of play; and, when a joint is in the near vicinity of a fracture, it is well to practise passive motion of it very carefully, at an earlier period, at each undoing of the retentive apparatus, that stiffness may be avoided.

Use of the part must be resumed very gradually; more especially in the lower limbs. Many a fractured leg has been set free, at the ordinary time, of proper length, and void of all deformity; which nevertheless soon became both shortened and bent, to an extent which impaired both its symmetry and function. The callus is soft and pliable at first, as has already been observed; and the motto of the convalescent should be "Festina lente."

Fracture with Luxation.

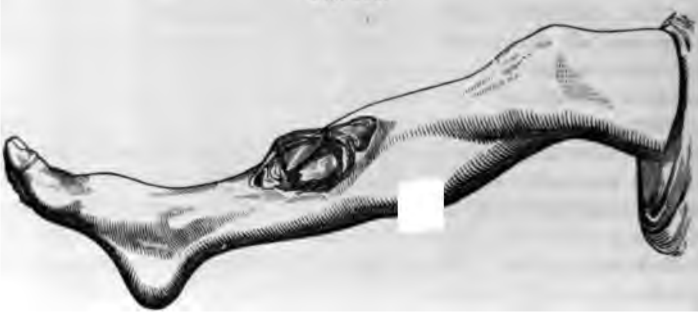
This is a rare complication of injuries; but sometimes occurs. As at the shoulder; the head of the humerus being displaced into the axilla, while fracture occurs at the neck of the bone. In treatment, the dislocation should first be reduced, if possible, by coaptating manipulation; and then the fracture may be managed in the ordinary way. Sometimes splints may be arranged on the broken limb, so as to restore its continuity in great measure, and permit ordinary extension to be employed against the dislocation; of course, greatly increasing the chance of success. But, if reduction fail, then the fracture must be attended to; and, when it has become consolidated, it is possible that attempts to reduce the dislocation in the usual way may succeed.

Compound Fracture.

The wound, which renders a fracture compound, may be made at once by the fracturing violence; or, subsequently to the fracture, by one or other of the sharp fragments protruding through the skin; or, at a more remote period, by sloughing or ulceration of the superimposed soft parts. The most ordinary examples are those effected by the two first causes.

If inflammation be wholly averted, the wound closes at once; and reparation of the fracture advances in the same way as in the simple form of injury. But when inflammation has become established—as it is certain to be in almost all the cases of severity—the work of repair is altogether delayed, until inflammation shall have abated. The union then is by the second intention, as in flesh wounds. The breach in the soft parts granulates and contracts, discharge gradually diminishing.

Fig. 230.



Compound and comminuted fracture of the leg.

And at the same time, the bone and textures around furnish plastic matter, which, becoming organized and ossified, effects reparation of the fracture; more slowly, and usually less efficiently, than when no inflammation has occurred; yet well enough to restore strength and general usefulness to the part.

The surgeon's first care is, to ascertain whether any attempt ought to be made to save the limb. In the slighter cases, there is no difficulty; but, in those of severity and complication, much careful and anxious thought, tempered by reference to past experience, is required, ere a just determination can be attained. In all cases of what may be termed decided doubt, it seems but reasonable that the limb should have the benefit of that doubt: and that, therefore, adjustment and retention may be instituted immediately, with a view to a tedious yet ultimate cure. When, on the contrary, we are satisfied, both from the appearance of the parts, and from our experience of similar cases, that a cure cannot be procured with the limb retained; that amputation must be performed, sooner or later, either on account of gangrene, or in consequence of the system's yielding under the hectic of a protracted and profuse discharge, the operation should be at once performed, to anticipate all such certain evils—so soon as the shock of injury shall have sufficiently passed away, and before inflammatory accession shall have begun.

It is not easy to lay down definite rules for guidance in regard to such primary amputations. But the following circumstances may be safely stated, as adverse to a favorable prognosis. Comminution of the bone, or fracture at several points; extension of the fracture into an important articulation; an open state of the joint; much bruising and laceration of the soft parts, rendering extensive sloughing inevitable, with a risk of gangrene invading the whole limb, and with a certainty of extensive and tedious suppuration following separation of the sloughs; laceration of a large artery, as evidenced either by hemorrhage, or by rapid formation of a large, bloody swelling; old age; and enfeeblement of the frame by disease, privation, intemperate habits, or other cause.

When, on the other hand, circumstances are favorable, and it is determined to save the limb, if possible—reduction is to be effected, carefully, gently, immediately; and with due attention to muscular relaxation by position, as in the simple form of injury. If fracture be oblique, and a sharp end of the bone protrude to some distance through a comparatively limited opening in the integument, difficulty is not unlikely to be experienced in effecting the desired replacement; and a question will naturally arise, as to whether the wound is to be enlarged, or the bone abbreviated. In general the latter alternative is preferable; for, *cæteris paribus*, the smaller the integumental wound, the less the hazard of compound fracture. The projecting portion, therefore, is to be removed, by saw or bone-pliers, to the requisite extent. And then, the bone having been accurately adjusted, our care is directed to the integumental wound; which, having been brought neatly together, when at all approaching to the incised in character, is treated for adhesion. Stitches should be avoided, if possible; the preferable retentive agent is adhesive plaster or collodion. And when the wound is very limited, scarcely exceeding a puncture in dimensions, the dressing should be made to cover it completely, so as wholly to exclude atmospheric air; thus rendering immediate union very probable. It is obviously a great matter, if, in the course of the first two or three days, we can succeed, by such means, in converting a compound into a simple form of injury. But, when the wound is plainly bruised, torn, or of such a form that adhesion is impossible, water-dressing is applied in the ordinary way, as suitable for granulation; approximation being intrusted to position and adhesive plaster; and sutures never being employed. At first water-dressing is cold, and kept continuously so; for the purpose of allaying and moderating the inflammation. The method of irrigation is often very suitable.

Retentive apparatus is applied, in the same way as in simple fracture; but with especial care, so as to avoid both undue motion, and undue pressure or constriction at any part. And the splints and bandages should also be so constructed and arranged, as to leave the wound capable of being readily exposed, for the purpose of inspection and dressing, without any undoing of the general apparatus. On this account, the many-tailed bandage or a series of slips of bandage, is preferable to the common roller; at all events, in the neighborhood of the injury. At first, antiphlogistic regimen is more especially necessary than in simple fracture; both the likelihood and the hazard of inflammation being greater. And, should inflammation threaten in a decided manner, general bleeding, antimony, and other active antiphlogistics—purgatives excepted—are to be energetically employed; unless contraindicated by age, or other debility of system; and yet, in severe cases, always with an eye to the ulterior result—the coming period of suppuration and hectic.

When the bone is comminuted at the site of fracture, a question often arises as to the expediency of removing the fragments; whether they are likely to die, and so to delay the cure, perhaps preventing union altogether; or whether they are likely to retain their vitality, and so both facilitate the cure, and render it more satisfactory when it has occurred.

If fragments are completely detached, they should certainly be removed at once; even now they are foreign bodies. If they are well connected, not only by periosteum, but by the surrounding soft parts, they should be carefully replaced and retained in their proper position, with a view towards consolidation. If they are connected only by periosteum, they may be still left, with good hope of reunion, in the young and healthy; but, in the old, and in the case of gunshot injury, they had better at once be taken away. If, at any time, their necrosis becomes certain, they are to receive the same treatment as dead portions of bone under ordinary circumstances; spontaneous detachment is be patiently awaited, and then the loose sequestrum is to be lifted away. Sometimes, when necrosis has been slight and gradual, and has occurred late in the cure, provisional callus enacts the part of the substitute bone, and may confine the sequestrum. In this case, the definite callus cannot form—for the sequestrum occupies its place; suppuration will continue, more or less profuse; the fracture cannot unite; and the whole frame is likely to give way, by hectic. Still, amputation is not inevitable. Let the principles of treatment applicable to necrosis again be carried out; let callus be divided, so as to expose the sequestrum, and admit of its removal; then reapply retentive apparatus, and conduct the treatment in the ordinary way.

When suppuration has become established, is moderate, and limited to the wound, continuance of simple water-dressing is sufficient. When, however, suppuration threatens to become diffuse, or abscess forms in the vicinity, free and early incision is to be had recourse to, with fomentation, and hot epithems, and especial quiet of the limb. In fact, the general principles of treatment suitable to abscess are to be enforced. No squeezing or pressure is at all warrantable, during the acute stage; if the matter cannot otherwise be prevented from undue accumulation, a dependent counter-opening must be made unhesitatingly.

Should gangrene invade, or plainly threaten to invade, the whole limb, during the inflammatory stage, amputation, immediate and high, affords the only chance of safety. Later, when the frame is plainly unable to struggle longer, with a prospect of success, against the hectic cause, amputation is also demanded. A part must be sacrificed to save the whole.

Hemorrhage is sometimes troublesome in compound fracture. It may occur at the time of injury; an important artery having been punctured or torn. The bleeding point is to be sought for, and secured by ligature, as in ordinary arterial bleeding; the wound being dilated, if need be (p. 319).

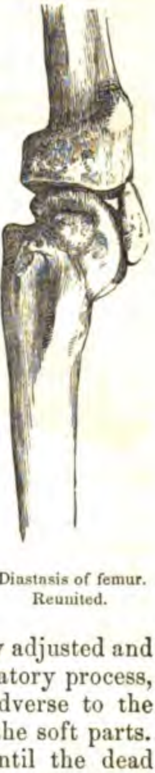
Or hemorrhage may take place during the progress of cure; by ulceration, either during separation of the sloughs, or at a more remote period. Or it may be the consequence of an invasion of sloughing phagedena. If such bleeding be trivial, evidently proceeding from a vessel of no great magnitude, it may be restrained by pressure, moderately, but accurately applied. If on the contrary it be important, and plainly from a vessel of high class, restraining pressure is to be assisted by deligation of the main arterial trunk on the cardiac aspect; ligature of the femoral, for example, being practised on account of secondary hemorrhage after compound fracture below the knee (p. 322). The process of cure is not necessarily delayed, or rendered imperfect, by the occurrence of such an accident. Should deligation fail—as is not likely—amputation is the last resource; but one which, fortunately, seldom requires to be adopted.

Diastasis.

Sometimes, in the adolescent, an epiphysis is the means of preventing compound dislocation, and determining compound fracture. For instance, when a severe wrench is sustained at the ankle, the natural tendency is probably to compound luxation of the tibia inwards, but the bone yields at the conection of its shaft with the epiphysis; the latter portion remains undisturbed in its place; while the lower end of the shaft, of a transverse and indented aspect, protrudes through the integument. This form of accident is termed *Diastasis*—and is amenable to the same treatment as compound fracture in general. In most cases, it is rather a favorable occurrence than otherwise; the patient being likely to suffer less, and to retain a more useful limb, than after compound dislocation.

Occasionally, diastasis takes place, without wound of the soft parts. The condyles of the femur, for example, may be twisted from the shaft. The same treatment is required as for simple fracture; with perhaps more care in both reduction and retention.

Fig. 231.



Diastasis of femur. Reunited.

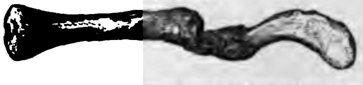
False Joints.

Ununited Fracture.—A fracture may fail to unite from various causes. 1. If motion be permitted, and still more if it be made, daily or even occasionally, the formation of provisional callus will be disturbed, and the definitive is likely to be altogether frustrated; the part will probably remain pliable. 2. Or the parts may be duly adjusted and retained, and reunion may fail by excess of the inflammatory process, in any way induced; true inflammation being quite as adverse to the process of healing in bone, as it is in a wound or ulcer of the soft parts. Necrosis, as already stated, is an insuperable obstacle, until the dead portion has been extruded. 3. From constitutional defect, or atmospheric accident, there may be a want of effort in the part; plasma is deficient; and what is produced is but imperfectly organized; just as an indolent ulcer of the leg refuses to heal. The last, however, is by much the most rare occurrence of the three.

It may happen that a portion of the soft parts—as a slip of muscle—has become lodged between the fragments. Until displaced, it is plainly a mechanical obstacle to reunion. Age, also, and long-sustained habits of intemperance, are sure to delay, and sometimes may prevent the cure.

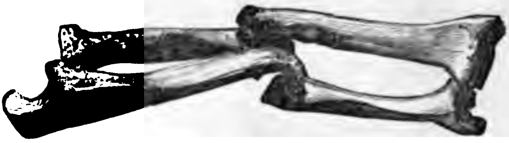
Disunited Fracture.—A fracture, having been consolidated in the ordinary way, may again become loose and movable. This may be the result of fresh mechanical violence, occasioning immediate disruption of the connecting medium. Or it may be a more tardy but equally certain process, the result of inflammation; induced by a less degree of external violence, or by any other cause; as a wound, recently united by adhesion may be made to gape, even wider than before, by accession of inflammation, suppuration, and ulceration. Or the disjunction may be the result of constitutional disorder, entailing a remarkable tendency to absorption of all recent structures, whether in the hard or soft tissues; as is not unfrequently exemplified by disunion of fractures, on board of ship, in consequence of scurvy (p. 65).

Fig. 232.



Unuited clavicle. The two portions of bone are merely connected by ligamentous substance.

Fig. 233.



False joint in the forearm. The bones play on each other, by a new hinge-like joint.

The *False joint* which results either from disunited, or from ununited fracture, bears no true resemblance to normal articulation. There is neither articular cartilage, nor synovial apparatus. The ends of the bone taper somewhat, and are rounded off; they are invested by a dense fibrous expansion; and, by a similar texture of less density, they are joined together. By such an arrangement, extent of motion is abundantly favored; and a limb so circumstanced, is, if unsupported by extrinsic aid, almost wholly useless as an organ either of prehension or support. The occurrence is more frequent in military than in civil practice; for two very obvious reasons. First, means for duly conducting the treatment of fracture are less available; secondly, the bruising inflicted by shot-wounds is inimical to satisfactory processes of cure, both in the soft and in the hard tissues.

Treatment of False Joint.

To undo the apparatus of a fractured limb, and to find the solution of continuity in the bone still unrestored, at the end of four, five, six, seven, or eight weeks, is no demonstration of the expected union having altogether failed. It may be that the formation of *definitive* callus is yet in progress; and, if undisturbed by movement of the limb, this may be completed in no unreasonable time. The provisional callus has, doubtless, failed; but in truth, this is not essential to osseous reunion (p. 619). When it does exist, it is but a ferrule or clasp tightly embracing the broken part, rendering it immovable, and seeming to restore its actual continuity; as a like binding agent may give continuity to two pieces of wood, and make them as one. But, so far as the binding agent is itself concerned, there is as little actual restoration of continuity of texture in the bone as in the birch. Provisional callus only enacts the part of a steady splint, until the process of true consolidation has been completed by elaboration of the definitive callus, whereby there is, as it were, an interweaving of texture between the broken ends. It takes some time to construct this splint, and to apply it with due tightness; four, six, or eight weeks, as may be. During its construction it is necessary to steady the parts by external means; and that is the province of the surgeon. After it has become firm in itself, and tightly applied to the bone, then it is capable alone of restraining motion, so as to permit true consolidation of the broken ends; and the surgeon's splints may be now taken away. In short, under such circumstances, there are three distinct means towards the final cure:—1. Surgical splints to steady the parts until provisional callus is formed and completed; 2. This provisional callus, or Nature's splint, to secure perfect immunity from motion, until the definitive callus has been constructed; and, 3. This definitive callus, by whose gradual elaboration and modification, true continuity in every part of the texture is ultimately restored. When No. 2 is finished, No. 1 is useless, and is taken away by the surgeon's hands; when No. 3 is complete, No. 2 is removed by the busy labor of absorption; No. 3 remains, but is ultimately much modified also by absorption. Neither No. 1 nor No. 2, however, are absolutely essential in themselves to the formation of No. 3 (p. 619); and if No. 1 be present, No. 2 may all the more be dispensed with. Of the series, the only one which is truly essential is the last. Bones may knit by provisional callus, though no surgeon is by, and no splint is applied—though not so well; and they may also unite—perhaps not much after the ordinary period—though provisional callus may have proved either faulty or altogether defective. That is, union *may* take place, independently of the splints both of the surgeon and of Nature. Flat bones, such as the cranium, unite mainly, if not solely, by definitive callus; and fracture of the neck of the femur, within the capsule, if it unite at all, can do so in no other way. The process of union, no doubt, is favored by the presence of both splints in due succession, first the surgeon's, and then that of Nature; but still it *may* be completed, independently of one or other of them, or even of both.

Supposing then, that on removal of our splints, at the end of the accustomed period of probation, we find the broken ends still movable on each other, it is manifestly our duty to reapply the retentive apparatus with still greater care than formerly, and to keep it so applied for a very considerably greater period than was at first contemplated, it having now a new duty to perform: not to keep the parts steady till provisional callus clasps them tight; but to take the place of this callus and to keep the parts steady for a longer period than before, so that the definitive callus, now supposed to be in progress, may duly advance to completion. And not until a reasonable period of probation—say four, five, or six months—for the construction of this, the essential part of the uniting process, shall have passed away, does the surgeon abandon either the careful use of his simple retentive apparatus, or the hope of cure.

In regard to this form of "ununited fracture," there need be no two opinions as to the right mode of treatment; namely, to put up the limb afresh, to keep the parts immovable, and to maintain the general health and powers of system, in as vigorous a condition as possible. Starch splints are here extremely suitable. At the same time, the general health is attended to; diet is generous and stimuli also may be necessary—to maintain energy of system for duly sustaining local repair.

But when, at the end of four, five, six months, or more, we find the limb still loose and movable at the site of fracture, it is a sign that the ordinary process of reunion has failed in all its parts. And the same conclusion is forced upon us in cases of an earlier date—six or eight weeks only, it may be, after the accident—in which mobility is great, in which a space, defective in everything like restorative means, can be felt between the ends of the bones, and in which these can be plainly felt blunt, tapering, and rounded. In such cases it is, that difference of opinion prevails as to best modes of treatment, and latitude exists as to their selection.

It naturally occurs to one, that it would be desirable to restore something like the state of matters which exists at the first, immediately after the injury has been received; so that we may start again in treatment *de novo*. Accordingly, among other plans, it has been proposed to expose the part by incision, to saw off the ends of the bone, and then, closing the wound, to re-adjust all carefully. Thus is a recent fracture re-established no doubt, but it is a compound one; and, being so, it is by no means an improvement on the original casualty. The proceeding proved unsatisfactory in practice, and may be said to be now abandoned.

When the principle of "subcutaneous incision" came into use, the idea struck me that this important addition to surgery might be made available towards the remedy of ununited fracture; and accordingly I proposed that a strong needle, having been passed obliquely down to the part, should have its edge freely moved about in all directions, so as to cut up the ligamentous bond of union, as well as the dense investment of the ends of the bones; the needle being then carefully withdrawn, and the puncture covered by plaster or collodion. The parts will probably be reduced to a state very similar to what attends on ordinary fracture at the first. A pouch of blood will form; the blood will be absorbed; fibrin will take its place; inflammation being absent, the plasma will become organized, while at the same time, secretion and organization may advance from the ends of the bone; and consolidation, as by definitive callus, be completed.

The connecting materials of the "false joint" are disrupted and excited, not destroyed. They are valuable towards the formation of bone, when brought into and maintained in a state of moderate vascular excitement. "A state of active hyperæmia generally precedes the osseous transformation of the fibrous, cartilaginous, and fibro-cartilaginous tissues. M. Rayer observed, that when he excited an artificial irritation in the fibro-cartilage of a rabbit's ear, the part was at first softened; a yellow matter was next deposited in its texture; and, finally, a calcareous deposit was formed, and a true ossification produced. M. Cruveilhier likewise observed different portions of periosteum, ligaments, and cartilages, pass into the osseous or ossiform state, under the influence of different stimulating applications."[1]

My experience, as far as it goes,[2] speaks in favor of the practice.

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[1] Andral.

[2] Monthly Journal of Medical Science, June, 1848. Lately, this method succeeded, quite beyond my expectation, in consolidating an ununited fr f the humerus, which had

It is surely better than—though somewhat like—the practice of John Hunter, whose treatment of an ununited fracture of the humerus, Mr. Samuel Cooper tells us, was as follows:—"There was an artificial joint, and he made an incision into it; and then having introduced a *spatula*, he irritated the whole surface of the artificial joint. This brought on considerable inflammation, which ended in anchylosis, and the patient was cured." The subcutaneous puncture and the needle, if they are likely to obtain the same ultimate result, are surely preferable to the incision and the spatula. White's severe operation of cutting down, and sawing off the ends of the bones, was not only hazardous to life, but not unfrequently failed to accomplish the end in view; in some cases it proved fatal. Rubbing the ends of the bone rudely together, and then reapplying retentive apparatus as before, has hitherto given no encouraging success. Dr. Physick's seton is less formidable than the saw; but chance of failure with it is not slight, and in fractures of the lower extremity, indeed, its success may be regarded as only the exception to the general rule. Mr. Amesbury applied continuous and severe pressure on the parts, so as to force and retain them in accurate re-adjustment; but his system has not come into vogue, and is rather looked on as painful, irksome, and uncertain. Dieffenbach exposed the bone by incision, drove a peg of ivory into each extremity about half an inch from the line of fracture, and then by wire firmly and closely connected the two; expecting that the foreign body would rouse a plastic exudation which would abundantly suffice for consolidation of the fracture now so accurately retained. Experience has spoken favorably of this practice; an ossific process being established similar to what takes place in necrosis. Lately Mr. Burman has employed galvanism as an exciting agent, and with success, in the case of an ununited fracture of the tibia of fourteen weeks' duration.[1] There were other means at work, however; namely, an improved diet, and constant firm pressure on the fractured ends. It may have been the galvanism alone that moved the plasma and its organization; but many perhaps will be inclined to rank that agent rather as an adjuvant than as a principle. To the method by subcutaneous puncture it might prove a powerful auxiliary. The simultaneous use of both is not incompatible; and, in these days of anæsthesia, the repetition which either may require cannot be considered as cruel and objectionable. From neither, conducted with ordinary prudence, can risk of untoward casualty be suspected.

Should the method by seton be preferred, a caoutchouc tape, or skein of silk or cotton, is inserted between the ends of the bone, and permitted to remain there, for some days, until sufficiency of plasma has been exuded around, in the shape of the organizable fibrin which always attends more or less on the lodgment of such a suppurative agent. We wish for inflammation, and excite it, because it brings fibrin; and we maintain the inflammation until a sufficient tendency to the importation

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sustained compound injury about ten months before. The bones overlapped, and could not be adjusted. Altogether the case was so very unpromising as led me to remark, while performing the subcutaneous puncture, that it was an unfair test of the practice; and that, under such circumstances, a successful issue could scarcely be expected. Yet, on the first undoing of the splints, five weeks after the puncture, the parts were found quite firm.

[1] Monthly Journal, Feb. 1848, Retrospect, p. 12.

of fibrin has been so established. But, when this latter object has been attained, we withdraw the cause and moderate the result; in order that the fibrin may not run to waste and be discharged as pus, but become plastic and remain, available for the purposes of repair.

On the whole, perhaps the following statement will express the right sequence of practice. In recent and favorable cases, place the limb in starch bandages, with or without subcutaneous puncture. In more advanced and determined, but yet favorable cases, employ subcutaneous puncture, freely, and perhaps with repetition. In the least favorable cases—more especially if these other means have failed—employ either the seton, or the ivory pegs.

When non-union is obviously dependent on the impaction of a slip of muscle between the fractured ends, or on the presence of a piece of dead bone, or on the lodgment of a foreign body from without, immunity from motion, with attention to the system, after removal of the cause, usually suffice for cure.

Of course in no case is local treatment exclusively to occupy our attention. Constitutional management must never be overlooked; and often it proves of the highest importance.

Should cure of the false joint fail, palliation may be obtained, and the part rendered tolerably useful, by the application of a tight, unyielding, broad belt, or ferrule; an imitation, as to effect, of the provisional callus.

In some extreme cases, the state of matters is so manifestly hopeless, by reason of irremediable displacement, as to warrant recourse to amputation.

Petit, Traité des Maladies des Os, Paris, 1742; Pott, Surgical Works, Lond. 1808; Breschet, Recherches Historiques et Experimentales sur la Formation du Cal, Paris, 1819; Boyer, Traité des Maladies Chirurgicales, &c., Paris, 1822–28; Cooper (Sir Astley), on Dislocations and Fractures, Lond. 1822, last edition, Lond. 1842; Dupuytren, Leçons Orales, Paris, 1832–34; Miescher, de Inflammatione Ossium, &c., Berol, 1836; Meyer, die Lehre von den Fracturen, Ber. 1843; Lebert, Physiologie Pathologique, Paris, 1845; Dupuytren, on Diseases and Injuries of Bones, published by the Sydenham Society, Lond. 1847; Paget's Lectures on Repair, Med. Gazette, 1849; Cyclopædia of Surgery (Art. Fracture).

CHAPTER XXII.

DISLOCATION.

DISLOCATION, or Luxation, denotes displacement of a joint, the bones remaining entire. Some joints are more liable than others to such injury; first, those of the ball and socket construction, as the shoulder and hip; next, the ginglymoid, as the elbow. And, again, the articulations most exposed to external violence are necessarily the most liable to displacement.

Dislocations may occur at any age; but are most frequent during the middle period of life. In advanced years, fracture is more common. In early adolescence the accident is rare; and yet examples are not wanting. Even at five years of age, dislocation of the hip has happened in an ordinary way.[1] Congenital Luxations are by no means rare; and are of different kinds. 1. *Obstetrical;* the result of accident by force in delivery. 2. *Spontaneous;* caused by articular disease, in utero. 3. *Functional;* by functional disorder of the muscles, dependent on derangement of the nervous system; in utero. As in clubfoot. 4. *Original;* by arrest of development; the articulating apparatus being incomplete.[2]

The *Causes* of luxation are, first, *Predisposing*. Peculiarity of construction and site, as just stated, may be said to be of this class. Also, weakness of surrounding muscles plainly favors the occurrence. The muscles afford much support, even in the dead body, to the joints; and any articulation, which lacks that accustomed aid, will be especially liable to dislocation. The joints of atrophied and paralysed limbs, consequently, are in especial danger. Undue elongation of the proper articulating apparatus also predisposes; whether this be the result of external violence—as in the case of over-extension—or of chronic disease. Accumulation of fluid in a joint predisposes, particularly in those of ball and socket construction; inasmuch as that effect of atmospheric pressure is thereby interfered with, by which the articulating ends are kept in apposition. Destructive disease of joints manifestly tends to their displacement, as formerly stated; only a slight force is sufficient, when the retentive structure has almost all fallen before ulceration (p. 450). One act of dislocation predisposes to another. A joint, once luxated, is especially liable to redisplacement; for the muscles have been weakened; the articulating apparatus has been stretched and elongated; and the latter, too, may be yet deficient at the part where the end of the bone formerly escaped.

The *Exciting causes* are, like those of fracture, external violence and muscular action. A blow or fall, as was stated, may occasion fracture, whether the force be applied directly or indirectly; most frequently, the break is from direct violence. Dislocation, in like manner, may be produced either directly or indirectly; but is most likely to occur, when the force is indirect—applied at the end of a long bone, and operating indirectly on its further extremity. Thus, a patient, falling directly on the shoulder or hip, is most apt to suffer fracture. Whereas, when he falls on the hand or foot, knee or elbow, and the injury is sustained at the hip or shoulder, it is much more likely to be dislocation. The muscles surrounding the joint, were they on application of the violence to act all at once, in unison, would doubtless support the part, and oppose the displacing agency. But one or two, acting with suddenness and energy, will plainly tend rather to favor the occurrence of dislodgment, as well as to determine the direction in which it is to take place. Again, muscular action, alone, may effect luxation; as in the case of the lower jaw, dislocated by yawning; also in those cases in which there is naturally much laxity and elongation of the articulating apparatus, and in which, consequently, the patient may have almost a voluntary power in effecting displacement.

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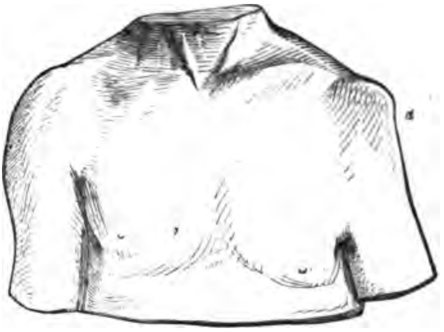
[1] Lancet, No. 1280, p. 285.

[2] British and Foreign Review, No. xlii, p. 393.

When the accident results from muscular action alone, or in consequence of relaxation of the ligamentous apparatus, there is seldom, if ever, any laceration of muscle, ligament, or tendon. But when it is produced by external violence, sudden and severe, operating on a part previously in a normal state, there is usually a giving way, by laceration, of the capsular ligament, and of muscular fibres exterior to it—those which may happen especially to oppose the displacement; tendon, too, may be either ruptured, or torn away from its osseous insertion. Such disruption of the parts exterior to the joint, doubtless aggravates the nature of the injury, and favors extensive displacement; but, at the same time, fortunately, reduction is by the same circumstances facilitated.

The *Symptoms* of dislocation are:—signs of displacement, more or less obvious; a swelling where none should be, or a hollow where the surface should be even or raised; shortening or elongation of the limb, as the case may be—more frequently the former. Much pain is complained of; particularly if a nervous trunk or plexus be compressed by the head of the bone; as in dislocation of the humerus into the axilla. And, usually, the patient is found, immediately after the accident, laboring under a marked shock or depression, often severe. Motion is very much impaired. The patient cannot raise or move the part; neither can the surgeon; and any attempt to do so, on the part of either, is attended with great increase of suffering. The part is locked

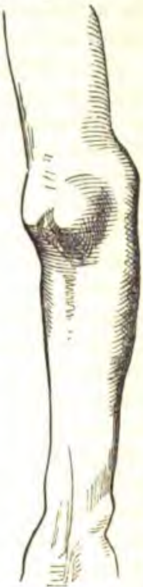
Fig. 234.



Dislocation of the shoulder. The flattening shown at *a*. The right shoulder is normal.

some hours have elapsed. At first, the peculiar immobility may not be very distinct, in consequence of muscular relaxation attendant on the shock; particularly if the patient happen to be by no means of a robust and muscular frame. But, when the state of depression has passed away, spastic rigidity seizes on the muscles implicated in the hurt; and, by them, the bone is locked firmly in its new and unnatural situation. There is swelling as in fracture; at first, from bone being where no bone should be; subsequently, from more or less sanguineous infiltration, or accumulation; and, more remotely, from the effusion and exudation which attend on an aroused inflammatory process. On attempting motion, the bones are found entire in their continuity; the head moving obediently with the shaft. No crepitus is felt; but there may be a simulation—of a soft, sloppy, oozy character; wholly distinct from the dry, rough, crepitus of fracture, and never to be mistaken by an experienced hand or ear. Sometimes, however, there is an obscure and true crepitus on the surface of the part; from movement of osseous scales which may have been torn off the muscular or tendinous insertions. Nerves may be compressed or torn across; and numbness, or complete local paralysis will ensue. Compression is more frequent than laceration; and, consequently, temporary numbness is more common than complete loss of power. Or, again, a certain nervous branch may be torn, while the principal nervous trunks are but temporarily inconvenienced; and, while the limb generally may recover its nervous influence, immediately on reduction, one part may remain deficient, either for a time or permanently. Thus, in dislocation of the shoulder, the circumflex nerve is apt to be seriously injured; causing paralysis of the deltoid.

Fig. 235.



Dislocation of the elbow; showing preternatural fulness in front.

On simple extension being made, the proper length of the limb is not restored, as in fracture. This is only effected by energetic extension, producing reduction; and, when effected, the limb remains of its due proportions; there being no reproduction of displacement, by muscular action, on mere cessation of extension, as in fracture. Usually, also, there is an obvious change of relative position; affecting not only the part, but the whole limb. In the common dislocation of the hip, for example, not only is the trochanter major changed from its normal relative position, but also the toes and limb are turned remarkably inwards. And this change of relative position cannot be altered, by gentle manipulation, as in fracture; but only after reduction; and, then, the restoration is permanent.

It is obviously of the highest importance, that, in suspected luxation, our diagnosis should be prompt and accurate. An immediate and careful, determined, yet gentle examination is therefore to be made; if possible, before either inflammatory or bloody swelling has ensued. The sooner we determine the nature of the accident, and the sooner suitable treatment for reduction is adopted, thereafter—when satisfied of the existence of luxation—the better it is for both patient and surgeon. The longer the period which elapses between infliction of the injury and the attempts at reduction, the greater are the difficulties and dangers which are to be encountered.

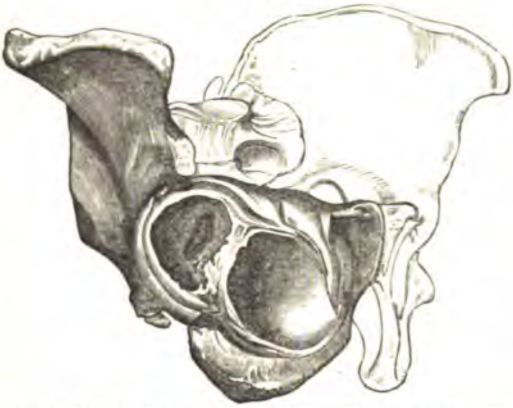
Anæsthesia contributes greatly to accuracy of diagnosis; obtaining two most important results. The patient suffers no pain, however free or protracted the examination; and, the muscles being thoroughly relaxed, the surgeon performs his manipulations with as much facility as on a dead body. Besides, it is not unlikely that subsequent inflammatory excitement will prove less than if the examination had been made on a suffering and resisting patient.

Dislocation of the hip may be simulated by morbus coxarius; but inquiry into the history of the case will sufficiently guard the practitioner against error. It is between fracture and dislocation that we are likely to be most in doubt. And it may be well here to repeat, shortly, the leading points of distinction. In dislocation, there is no true crepitus; motion, both voluntary and involuntary, is limited; the bone may be traced, entire, throughout its whole extent; simple extension will not restore due length to the limb; change of relative position is distinct, and, like shortening of the limb, cannot be altered aright until reduction has been effected—and, then, the alteration is permanent; application of the displacing force is usually indirect. Also, it is not unimportant to remember, that fracture is most common at an advanced age; while dislocations are seldom found but in the adolescent and adult, and most frequently in the latter.

Occasionally, dislocation is complicated with fracture. The fibula is usually broken in dislocation of the tibia; in dislocation of the hip, the acetabulum may be either chipped, or broken through; in dislocation of the elbow, the coronoid process of the ulna may be detached. And examination of the injury should always be conducted, with a view to the possibility of this occurrence. For, if fracture coexist, the retentive means must be much more carefully adjusted and maintained than in simple dislocation.

The consequences of dislocation are important. The muscles—at first relaxed, during continuance of the shock of injury (p. 82)—become rigid in a few hours; and, if unopposed, tend to increase still further the displacement, as in fracture. After a time, they accommodate themselves to their new relative position. If stretched by the displacement, they become permanently elongated; if relaxed, at first, they become actually shortened, and condensed in bulk. If a muscle or tendon have been detached from its origin or insertion, it becomes fixed anew, by plastic deposit. If muscular fibre have been torn, the space is filled by an adventitious structure of ligamentous appearance and density; for some time more bulky than the vacancy which it is intended to occupy. The rent in the capsular ligament, as well as that in the exterior fibrous apparatus, becomes closed by plastic exudation—also, in the first instance, usually exuberant. A new cavity of reception begins to be formed for the displaced bone. If it rest on muscle, this becomes dense-ligamentous, smooth, and lubricated; hollowed, of a suitable fo the play of the bone. If it rest on bone, a cavity is formed there for its reception and play; partly by interstitial absorption, partly by new deposit around. And the surface of this new acetabulum, or glenoid cavity—as the case may be—becomes invested by dense ligamentous structure, well lubricated; which forms an excellent imitation, both in appearance and in function, of the normal articular cartilage. Not unfrequently, porcellanous deposit takes the place of the lining investment (p. 459). The displaced head of the bone, too, itself undergoes alteration; parting with its cartilage, flattening, and suiting itself generally to its changed circumstances. At the same time, the original articulating surface, now left unoccupied, begins to change; but the change is slow and long deferred, as if effected by a reluctant hand. As if Nature were unwilling to consider restoration hopeless; and were desirous to maintain an opportunity of return, to the latest possible period. After many months, nay after years of vacancy, the glenoid cavity has been found in such a state of suitableness, and so little altered from its original structure and dimensions, as to admit of replacement with complete restoration of function; and without any long time being required for re-establishment of the former freedom and extent of motion. In a macerated pelvis, evidently obtained from a patient who had lived long after the occurrence of dislocation, I have seen two acetabula in close apposition; the one original, the other of adventitious formation; and both apparently of almost equally efficient capabilities. After a time, however—various in different cases, yet never brief—the original articulating surface does change materially. Its cavity is filled up, and its investing cartilage disappears; its projections are rounded off by absorption; it becomes incorporated with the surrounding soft parts; and these changes take place all the more speedily and effectually, if the new articulating surface be in its immediate vicinity, and encroach on its boundary. There seems good reason to believe, also, that the less the ule has been injured, and the more freely it continues its

Fig. 236.



Old dislocation of the hip. A new acetabulum formed; while the original is but little changed.—SIR A. COOPER.

secretive power, the less speedy and complete are the obliterative changes in the original structure.

Treatment.—The paramount indication is *Reduction*, and cannot be attempted too soon. It consists of *extension*, to move the bone from its abnormal position, and to bring it on a plane with the articulating surface it has left; *counter-extension*, to steady the latter part, and to admit of extension being satisfactorily effected; and *coaptation*, to replace the surfaces in apposition. If the patient be seen immediately after infliction of the injury; still faint; with all his frame prostrate and relaxed; and incapable, by any effort, of throwing any part of his muscular system into strong resisting action—reduction may be expected to prove comparatively easy. The surgeon is able to cope with the accident, single-handed. In the case of the shoulder, for example, he takes hold of the elbow with his right hand, and gently extends the arm; while, with the fingers of his left hand, he pushes the head of the bone towards the glenoid cavity. After moderate extension, he makes a sudden, combined, jerking movement; and usually succeeds.

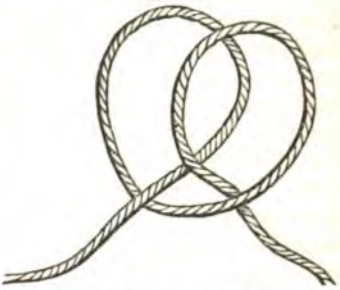
But when hours and days have passed, the obstacles to reduction are ever on the increase. The muscles are first spasmodically rigid, and then they leisurely adapt themselves to their new position; the track from the original articulating surface, through the lacerated ligamentous apparatus, is becoming more and more occupied by plastic exudation; and the displaced extremity of the bone is busy accommodating itself to the parts with which it is now in contact. Sometimes, the head of the bone merely projects through a narrow fissure of the capsule; and this, tightly embracing the bone's neck, becomes agglutinated thereto by plastic exudation, constituting a most serious obstacle to replacement.

Such being the impediments to reduction, the indications towards its attainment become very plain. By gradual yet powerful extension, muscular resistance must be overcome; by free rotation and movement of the end of the bone, new adhesions and deposits are to be broken up.

If only a few hours or days have elapsed, extension may be intrusted to the pulling of assistants. But, when the time elapsed is considerable, it is right at once to employ mechanical aid; making extension by rope and pulleys; and so employing a less force with more steadiness and precision. A sudden pull and jerk may often succeed in a recent case; they never can, in one of some duration. In such, suddenness and intensity of violence are never warrantable; for these are more likely to rupture muscles, arteries, or nerves, than to effect replacement of the bone. The muscular resistance is to be gradually exhausted, by constant and steady extension—determined, yet not violent. When this has been patiently effected, free movement of the end of the bone is made, to clear off adventitious hindrances; and then coaptation is attempted, as in the recent case. It is a common error to commence attempts at coaptation at the same time with extension. This does harm, by stimulating the muscles to a counteracting effort. Only after these have been exhausted by extending force, indirectly applied, should the surgeon's hand come to decided manipulation of the injured part. In some cases, he may have to wait, watchfully superintending the labor of his assistants and the pulleys, for but a few minutes; in others, his may be taxed for fifteen minutes, twenty, or more; that is, unless chloroform be employed.

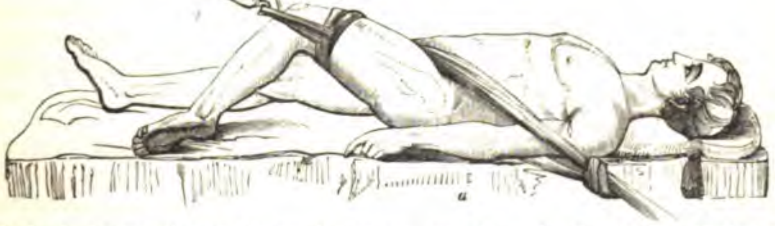
Extension by pulleys is made thus:—The patient is usually recumbent, on a mattress on the floor. A broad belt is passed under the perineum, or over the chest—according as it is the upper or lower extremity that is injured—and is secured behind to some fixed point on the wall or floor; in order that thus counter-extension may be sure, and the patient fixed in his place. A *laque*, or noose, is put upon the affected limb; a damp towel having been previously wrapped tightly round the part, to prevent excoriation. This laque usually consists of a stout band of worsted, secured by what is termed the clove hitch; the advantage of which is, that, while it holds a firm grasp, it cannot be tightened by pulling so as unduly to constrict the limb. To the laque, the pulleys and rope are attached by a hook; the other hook is secured to a fixed point opposite the patient; and then the rope is steadily pulled, as the surgeon may direct. Instead of the laque, a circular band may be adapted to the part, and tightened by a screw; but the former is more convenient, and fully as efficient. A question may arise as to the point of its application. If attached to the distal end of the *bone* affected—as above the knee, in dislocation of the hip—extending force is doubtless exerted more directly, and with greater power, on the displacement; and, from bending of the leg being permitted, the desired rotatory movements of the head of the bone can be more readily and powerfully performed. Yet it may be, that a near application of the noose may have the same effect as too early attempts at coaptation; stimulating the implicated muscles to resistance of the extending power. If attached to the distal extremity of the *limb*, on the contrary—as above the ankle, in the referred to—the extending force is indirect, and loses some-

Fig. 237.



The clove-hitch; shown on a coil of rope.

Fig. 238.



Mode of reducing dislocation shown. At *a*, counter extension made; at *b*, the laque attached to the thigh; at *c*, the pulleys.

what of its power by transmission through the intervening knee-joint; also, rotation is less easily effected. But, at the same time, an obvious advantage results, from the great length of lever which can then be employed in moving the head of the bone. On the whole, the former position of the laque—on the end of the bone—will be found generally preferred; the more especially as nowadays muscular resistance is certain to be annulled; as will presently be stated.

The direction in which the extending force is to be applied, must vary according to the nature of the individual dislocation.

But the patient is not at once to be attacked by mechanical force. There are powerful auxiliary means which are invariably to be used in the first instance, in all cases where difficulty of reduction is anticipated. The less force employed, the less severe and hazardous will be the reductive efforts. We shall save the risk of rupturing muscle, artery, vein, and nerve, or of at all events so injuring the parts as to kindle an active inflammatory process in them. The muscular system may be overcome by other means than an extending force; means not directed to the part, but to the whole frame. We imitate the state in which the patient is found immediately after infliction of the injury; when the opportunity is so very favorable to reduction, by reason of the prostrate and unresisting condition of the whole muscular system. The patient is to be temporarily enfeebled. A large bleeding from the arm will effect this; but the same object may be obtained without waste of the precious fluid; and, therefore, such other means are preferable. The patient may be put into a warm bath, and kept there till faintness ensue; or tartar emetic may be given, in repeated doses;[1] or tobacco may be administered—in fume, by chewing, or in the form of enema—until the desired effect has been obtained. Or, incomparably the best of all—chloroform is inhaled, until the full effect of deep anæsthesia is produced; when every voluntary muscle becomes relaxed as if in death. And thus the double advantage is obtained, of procuring muscular relaxation at once more thorough and more temporary than by any other agent; while at the same time an otherwise very painful operation is completed on a quite unconscious patient. Besides, there being seldom any necessity for applying much force, to extend muscles already so much relaxed, the risks by tear and subsequent inflammatory excitement are greatly diminished.

The procedure to be followed, therefore, in cases of old standing is:—first to overcome the patient's muscular frame, and then to apply extending force, by pulleys, in the right direction; extension being made from the distal extremity of the bone or of the limb, as circumstances may seem to indicate. When extension has been steadily continued for some time, the implicated muscles plainly yield, the head of the bone becomes more loose and movable, and approaches the plane of the articulating surface, which it left; then rotation is to be practised freely, in order to remove those adventitious hindrances, by deposit and adhesion, which may be in the way of replacement. And this having been done, by coaptating movements of the surgeon's hands, the head of the bone is guided towards its normal position. The act of reduction is usually sudden; indicated sometimes by a distinct snap, but more frequently by a peculiar sensation, unattended by noise, as if a muscle, or the bone itself, had given way. The proper length of the limb is immediately restored; and normal relative position is re-established.

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[1] The native Indians are well acquainted with this practice. "In cases where they do not succeed readily, they nauseate the patient to a most distressing degree, and then find no very great difficulty in reducing the luxation."—*Monthly Journal*, April, 1846, p. 306.

In obstinate cases, a sudden slackening of the extending cord—combined with a jerking, coaptating movement of the surgeon, at the joint—greatly facilitates, in truth may effect, reduction. And during extension—if anæsthesia be not employed—it is well to engage the patient in a sustained conversation; insisting upon his answers; in order that he may not, by deep inspiration, make his trunk a fixed point on which muscular resistance may be raised.

So soon as the signs of reduction have occurred, the extending force is instantly desisted from.

It may happen that after patient extension, rotation, and coaptation, our efforts are all still unsuccessful; and yet the muscles are lax and passive; the head of the bone can be moved freely; it can be brought to the plane of the deserted articulating surface—and still it refuses to enter. In the case of the acetabulum, it may be the brim of the cavity which proves the obstacle; and, by a towel placed under the thigh, the bone may be jerked or tilted over that last obstruction, into its place.

But even this last mentioned addition to the reductive means may fail. Under such circumstances, it is plainly the formation of adhesions, and new deposit, which constitute the obstructing cause; and, if very free rotation have failed to overcome this, the case is undoubtedly suitable for applying the principle of subcutaneous section. A strong needle may be introduced, and moved in such a direction as to clear again an open passage towards the articulating cavity. The puncture having been carefully closed, the extending force is to be reapplied; and the coaptating means will then most probably succeed, and that readily. Still it must be remembered that there is a certain amount of risk in this procedure; and that three things are necessary to warrant its adoption—failure of all other simpler means, tolerable certainty of accomplishing the object in view, and rational consent of the patient.

In regard to old luxations, an important question arises, as to the time at which attempts at reduction cease to be warrantable. For after a considerable period has elapsed, the new articulation becomes very serviceable, and the old has begun to be effaced. Then, attempts at reduction, even the most strenuous, are likely to fail; and, having failed, the patient is left in a much worse plight than before—the normal state not re-established, the new adaptation interfered with, and arrested in its progress. Perhaps inflammation may be lighted up, and abscess ensue; at all events, there is much painful swelling, the partially recovered power of motion is once more undone, and weeks or months may have again to elapse, ere the part become so quiet and so useful as it was before the unfortunate attempt.

Some joints are more favorably situated than others, in this respect. Hinge joints, as the elbow, are with difficulty reducible after three or four weeks have elapsed. On the other hand, a ball and socket joint. as the shoulder, may be practicable after almost as many mon
definite rules can be laid down. All must be left to the de

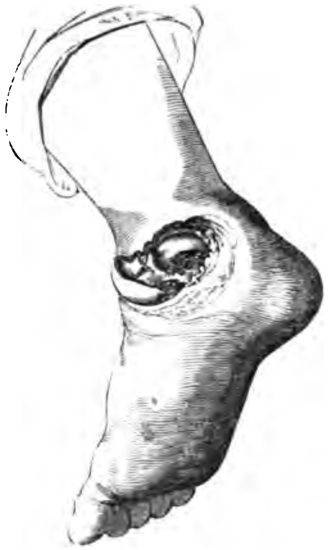
patient, and the judgment and experience of the surgeon. It being always remembered, that the principle of subcutaneous section, applicable to the vicinity of joints, may enable us to overcome perhaps the most serious obstacles to reduction in cases of old standing—obstacles which are not capable of being in any other way relaxed; that the original articulating cavity, if not interfered with by the new formation, remains long available; and that, therefore, the period during which reduction may be attempted, is to be regarded as considerably extended, beyond what the older authorities were willing to allow. Already, through the aid of subcutaneous section, dislocation of the humerus of two years' duration has been reduced, in all respects successfully.

In fractures, reduction is usually easy; while *retention* is accomplished not without care and trouble, and often with difficulty. Such matters are reversed in dislocation. Reduction is difficult, retention easy and simple. It is usually sufficient to bind down the limb, gently, by bandaging; so as to prevent any movement favorable to displacement. And when the patient is discreet and trustworthy, even such deligation may often be dispensed with. But in old dislocations of shallow joints, retention comes to be a very important indication. In the case of the shoulder joint, for example, it is often necessary to place a full-sized pad in the axilla, binding the arm firmly to the side; else redisplacement will certainly and immediately occur.

Prevention of subsequent evil, too, is ordinarily accomplished without difficulty. For a day or two after reduction, the patient is kept quiet, and on low diet. The part is fomented; and, if need be, leeches are applied. Higher antiphlogistics are very seldom required.

Pain and swelling having subsided, motion is to be gradually and gently restored; assisted by moderate friction. If a muscle, as the deltoid, remain weak and flaccid, its contractility may be aroused, and normal development favored, by powerful and stimulant friction, or by the application of electro-galvanism. Truth to tell, this last indication of *restoration* is in many cases the most difficult of fulfilment. Do what we will, joints sometimes remain long weak and useless.

Fig. 239.



Compound dislocation of the astragalus. —Sir A. Cooper.

Compound Dislocation.—This is dislocation with corresponding wound of the integuments; and, through this wound, the displaced bone usually projects to a greater or less extent. The ankle is most liable to this form of injury.

The same general observations apply, as to compound fracture. There is generally less bruising of the soft parts, less chance of arterial laceration, and, consequently, less likelihood of amputation being primarily demanded. The risk by subsequent inflammation, however, is infinitely greater than in fracture. It is a rare thing, when the joint does not inflame acutely and intensely; the cartilage and bone ulcerating, much pus flowing away, and the system becoming involved in the most severe general disturbance—at first intensely inflammatory, but soon verging towards the asthenic type. On this account, secondary amputation becomes not unfrequently expedient.

It having been determined to attempt preservation of the limb, removal of foreign matter first engages our attention. It is not unlikely, that the raw end of the bone has been in contact with the ground. Every particle of foreign matter must be carefully and gently wiped away. Sand, in a boot or shoe, is sufficiently troublesome; in the interior of an ankle joint, it must prove in the highest degree pernicious. Then the parts are reduced; the same preference being given to abbreviation of the bone, over enlargement of the wound, as in compound fracture (p. 627). Indeed, abbreviation often seems of much service, especially in compound dislocation of the tibia, at the ankle. Less tension ensues, space for the inflammatory tumescence being considerably enlarged; and, in consequence of the comparative absence of tension, inflammation proves less severe, and less destructive in its results.

Reduction having been duly effected, the wound is brought together; usually without sutures; and retentive means are carefully and lightly applied, as for compound fracture. Moderation of inflammation, and prevention of other casualties, are also sought for in a similar way. In some cases, we succeed in arresting all intensity of inflammation; the part speedily recovers, and a certain degree of motion is retained. In other cases—and these constitute the majority—anchylosis results, after a tedious suppuration; perhaps accompanied with partial necrosis. Such stiffness, however, may be to a great extent atoned for, by increased play of a neighboring joint; in the case of the ankle, for example, tarsal motion becoming unusually extensive. In other cases, as already stated, amputation is demanded, to save life.

Both compound dislocation and compound fracture are especially liable to occur to the intemperate; and, in many cases, an apparently slight injury suffices for the infliction—more particularly of the former accident. *Delirium tremens*, consequently, is apt sadly to complicate the case, supervening within a short time after the accident, and usually determining an early and fatal issue (p. 85).

Subluxation.

By this term is meant incomplete displacement of a joint: the articulating surfaces remaining yet in partial apposition. It is not of frequent occurrence. An example is, partial displacement of the head of the humerus on the coracoid process. The injury may also occur at the ankle. But it is most frequently found at the wrist; the bones of the forearm—one or other, or both—being partially displaced towards the palmar aspect.

The causes, symptoms, and treatment, resemble those of dislocation; in a minor degree. Indeed, as in the first named example, the manipulations which are necessary to ascertain the nature of the injury, often

r effecting replacement. The consequences are usually
on and prevention are simple and easy.
have a voluntary power of causing and reducing such
ments, by muscular effort; as in the jaw, thumb, and
uch cases, there is doubtless an unusual laxity of the
aratus.

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e of Fractures. The works which treat of Fracture usually treat of
at, see especially Cooper on Dislocations, Lond. 1842; Pravaz, Traité
enitales, &c. Paris, 1847; Smith on Fractures and Dislocations, Dublin,
n the Etiology, Pathology, and Treatment of Congenital Dislocations of
ork, 1850.

CHAPTER XXIII.

OF SPRAIN, AND RUPTURE OF MUSCLE AND TENDON.

THE term *Sprain*, or *Strain*, denotes stretching and partial laceration of the ligamentous apparatus of a joint, without displacement of the articulating surfaces. The pain and shock, immediately following, are often as great as in complete luxation; and the former, after a time, becomes much more severe, probably in consequence of the unbroken continuity of the fibrous tissue favoring the occurrence of great tension. Swelling is usually considerable; and is both immediate and secondary, as in other injuries; at first slight, from extravasation of blood; afterwards considerable, from serous effusion into the cavity of the joint, and infiltration, by inflammatory accession, in the tissues exterior. The injury is always serious; painful and troublesome in itself; and apt to lay the foundation of organic change in the joint, of the most confirmed character. The joints least prone to dislocation are the most liable to sprain.

The indications of treatment are: to prevent, diminish, or remove inflammatory accession; to favor absorption of deposit and extravasation; to restore function; and to avert the occurrence of organic change. The joint is to be kept in a state of absolute quietude throughout; commanded by a splint if need be. Cold, continuously applied, is the most suitable immediate application; restraining extravasation of blood, and tending to avert inflammation. When this, notwithstanding, does occur, the ordinary transition is to be gradually made to warm applications; leeches, also, are applied, and constitutional remedies exhibited, as circumstances may require. After inflammatory excitement has passed away, the part remaining feeble and swollen, gentle friction and pressure are to be employed; with a view to favoring absorption, and so restoring the parts, without and within the joint, to their pristine state. But this indication must, in all cases, be begun and continued with extreme caution; lest a premature and inordinate stimulus be applied, and dangerous excitement recur. As swelling decreases, and all uneasy sensations abate, passive motion is to be employed, with a view to restoration of function; but used with the same caution as the friction and bandaging.

When immediate excitement has passed away, relief is often obtained from keeping the part constantly moist with a solution of arnica; the tincture diluted with water—very copiously, otherwise troublesome eruption is apt to ensue. Probably this remedy acts by favoring absorption of the exuded fluids.

In the thoroughly chronic stage, hard and long-continued friction is sometimes of decided service; suppling the joints, and freeing the play of tendons, by inducing absorption of lingering deposit. It is at this period of the case—not before—that the aid of professed "rubbers" may be obtained, with good prospect of advantage. However absurd the theories of the "sprain curers" may be, their practice under due regulation, is excellent. Left to themselves they ply their handicraft too much or too soon, as well as too often; and are ever discovering fresh sprains, where sprains have never been.

Should the inflammatory process threaten to continue, of a chronic character, counter-irritation is to be employed; as in ordinary circumstances; all motion, friction, or other stimulus being then avoided.

For some time, moderate bandaging is continued, to afford support; especially when the part is in use. And, for long after, especial care should be taken to avert fresh injury, or any other cause likely to induce disease. For the joint, notwithstanding all care in the treatment, too often remains both vitally and physically weak; liable to reproduction of the sprain, and to reinduction of morbid change, from but slight causes. Our prophylactic care will naturally be most sedulous, in those who, from scrofulous habit, are especially prone to affections of the joints.

Rupture of Muscle.

Muscular fibre not unfrequently gives way, to a greater or less extent, in those of robust frame, advanced in years, and unaccustomed to muscular effort, when, by circumstances, they are called upon to make sudden and powerful exertion; as in running, leaping, dancing, or lifting a weight. The muscle most frequently injured thus, is the gastrocnemius at its lower part; where muscular fibre ends, and tendon begins. The consequences are;—sudden pain; swelling and discoloration, by extravasation of blood; increase of swelling and pain, by exudation attendant on inflammatory accession; lameness; at first a chasm at the site of injury, more or less extensive, according to the amount of laceration; afterwards, a hard swelling there, caused by organized exudation which occupies the vacant space. At the time of injury, the patient usually has a sensation as if struck on the part, is sensible that something has given way, and falls to the ground.

Rupture of the quadriceps extensor femoris, at its lower part, by muscular exertion, is also not uncommon; and the biceps flexor cubiti, the triceps, the pectorals, the recti abdominis, &c., may be similarly affected.

The treatment consists of rest, and antiphlogistic regimen; the part being kept in such a position as to relax the affected muscle, and place its several fibres in contact. Union is not by reproduction of muscle, but by dense ligamentous texture. For obvious reasons, use of the limb is to be very gradually resumed.

Rupture of Tendon.

Tendon is ruptured, under the same circumstances as muscular fibre. This tissue is more resistful of violence than muscle, and consequently, in the tearing away of fingers or other parts by extreme force, long strings of tendon may be seen attached to the severed parts; the muscular tissue having given way, perhaps high up in the remaining limb.

The part most commonly affected by simple rupture, is the Tendo Achillis. The symptoms and signs of the injury are similar to those of ruptured muscle, but of a major degree. The pain and swelling are greater; the sensation of injury, and of something having yielded, is more distinct; and not unfrequently is accompanied by a tolerably distinct snap, or other sound. The hiatus, at the part, is wider and more apparent; the lameness is more complete, and falling is more certain.

Treatment is conducted as for ruptured muscles; if possible, with more care to prevent motion and insure apposition; and usually for a longer period. Reparation is by plastic exudation, which is at first redundant in volume; but, becoming more and more dense, it ultimately occupies the space to no undue extent; not constituting true tendon, but of a firm, fibrous character, very similar to tendon in appearance, and well capable of discharging its assumed functions.

Tendon, when cut, reunites in the same manner as after rupture. If the injury have been inflicted by accident, it is usually compound; the wound tends to inflame and suppurate; and the cure is likely to prove tedious, by granulation. When the division is by design, as for the cure of deformity, it is of subcutaneous character; reunion is simple, and comparatively rapid (p. 594).

In the latter case, it is not essential that the divided extremities should be in absolute contact; there is a power of efficient reproduction, even when a considerable space has intervened; a circumstance of much importance in modern surgery—directed to the relief of deformity.

Ununited Tendon.

A divided tendon sometimes fails to unite; leaving an unoccupied void between the separated extremities, and rendering the part almost or quite useless. To remedy this state, an incision may be made, in order to pare the retracted ends and unite them by suture. Or the process by subcutaneous puncture may be employed, as for ununited fracture (p. 555). Of the two methods, the latter, on account of its comparative mildness, is greatly to be preferred; experience having proved it to be quite successful.

Displacement of Tendon.

Tendon may be simply displaced, and so give rise to pain, swelling, and want of power in the limb. The tendon of the biceps flexor cubiti, for example, may be tilted out of the bicipital groove, and rest on the minor tubercle. The accident is somewhat obscure, the change of relative position being but slight. When detected, replacement is easily effected.

Hypertrophy of Tendon.

Tendons are liable, in the elderly, to become affected by simple enlargement; causing not merely deformity, but also pain, debility, and general loss of function in the part. The tendon most frequently observed to be thus affected is the Tendo Achillis near the heel. Treatment is by rest, discutients, and relaxation of the muscle or muscles implicated. To fulfil the last indication, for instance, in the case of the Tendo Achillis, it is well to walk but little, and with the heel of the shoe somewhat raised. Often a gouty diathesis attends, and requires to be attended to in the ordinary way (p. 64).

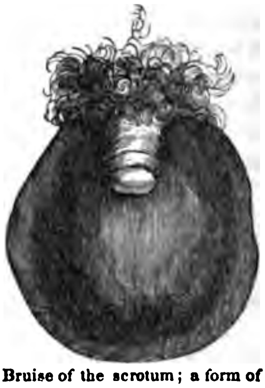
The matters treated of in this Chapter scarcely admit of a separate Literature. On Division of Tendons, see Stromeyer, Beitrage Zur Operativen Orthopædic, Hann. 1838; Phillips, Lectures on Surgery, Lond Med. Gazette, vol. xxvi, p. 244, 1840; Dieffenbach, Die Durchschneidung der Sehnen und Muskeln, Berl. 1841; Bonnet, Traité des Sections Tendineuses et Musculaires, &c. Paris, 1841.

CHAPTER XXIV.

BRUISE.

Bruise is caused by the forcible application of an obtuse body; and consists in more or less injury done to the interior of a part, without solution of continuity in the integument. The degree of severity varies, from the slightest contusion, to instant disorganization and death of the part. A spent cannon shot, for example, may, without breaking the skin, completely disorganize the part struck, reducing it at once to the condition of a jelly or pulp. Or, as happens frequently in contused wounds, the part may not be instantly deprived of life, but have its vitality so far weakened as readily to yield before subsequent inflammation.

Fig. 240.



Bruise of the scrotum; a form of Hæmatocele.

In ordinary bruise, however, there is no sloughing, either primary or secondary. The areolar tissue sustains a greater or less degree of disruption; blood is extravasated; and swelling results. Pain is felt at the time; of a dull kind, usually; but sometimes acute, when a sensitive part has been struck over resisting bone, as on the shin. After a time, the pain becomes aggravated, if any considerable degree of the inflammatory process supervene. And then, too, swelling is increased by the attendant exudation. If the process prove slight, the swelling soon begins to subside; exudation having ceased, and absorption begun. And, then, discoloration assumes the most prominent place among the signs of the injury; the superficially infiltrated blood, as it undergoes absorbent change, causing a variation of hue—from the natural color, somewhat heightened, to black or dark blue, thence to violet, from that to green, and afterwards to yellow. Gradually extravasation and exudation disappear, and the part is restored, almost to its normal condition.

If an arterial branch have been ruptured, of considerable size, tumor forms rapidly; and is distinctly fluctuating; consisting of escaped blood, yet in the fluid state. After a time, partial coagulation takes place; the clot being arranged at the circumference of the swelling, and the fluid portion occupying the centre. It is most important that this be distinguished from acute abscess; for it requires very different treatment. There need be no difficulty. The one is immediate, the other of secondary formation; the abscess is necessarily preceded and attended by all the usual symptoms of inflammation, the other is not. The same process of decadence takes place, as in ordinary bruise; swelling ceases; discoloration becomes marked and varied; extravasation, both solid and fluid, is absorbed; and ultimately, the normal color and form are both restored.

When an artery of some importance has given way, false aneurism may form, and follow the ordinary course. Or the vessel may speedily become obliterated, at the ruptured part, as in the more ordinary case just mentioned. The extravasation then gradually disappears, in the usual way.

The indications of treatment in bruise are, like those in sprain, to avert inflammatory accession, to promote absorption of extravasation and exudation, and to restore function. Rest, fomentation, antiphlogistics when required; followed by friction, support, and gradual resumption of use. When the tendency to sanguineous extravasation is great and obvious, immediate and uniform pressure may be expedient, for a time, in order to restrain the accumulation. And, however great this may be, even with pain and tension of the integument, incision should never be practised, at least in the first instance. Many ounces of blood may be absorbed in a short time, leaving the part but little injured by the temporary malposition. But, should only the most careful puncture be made, in even slight cases, the atmospheric stimulus is almost certain to induce inflammation; profuse and unhealthy suppuration ensues; incision is then required, in earnest, to save texture; the system is untowardly involved; and the cure is both tedious and unsatisfactory. Keep the skin entire; leave the blood to Nature during the period of probable excitement; and afterwards contribute towards absorption, by friction, pressure, or other suitable stimuli. A solution of the muriate of ammonia often proves a grateful and efficient sorbefacient, in such cases.

Should inflammation occur, and suppuration form in the infiltrated part, then free and early incision should be practised unhesitatingly; according to general principles. But, under all other circumstances, knife and lancet should certainly be withheld in the treatment of a bruised part.

Two vulgar errors obtain in the treatment of sprain and bruise; namely, the too early use of leeches and of friction. Nothing is more common than to apply leeches immediately after infliction of the injury, in order that they may suck out the extravasated, or "bruised blood," as it is called. But these little animals drink only from the running stream, drawing for themselves from the bloodvessels; and, therefore, they fail to perform what is expected of them by their employers. At the same time, their bites, admitting the external air to the extravasated blood, are likely to induce suppuration in the areolar tissue. They are of use only at a more remote period; to moderate inflammatory accession, occurring as a secondary result of the injury. Friction, in like manner, is often employed from the first and of a stimulating nature. The result is, to induce a

—an event which it ought to be our main

expedient, only after the period of excitement has passed; and, even then, it must be at first employed gently and with caution.

It should never be forgotten that bruise, though trifling in itself, may be most important in its remote consequences; that, as formerly explained, the plastic exudation and perverted function which ensue, may remain, and prove the nucleus of a tumor (p. 262). On this account, treatment should always be directed to complete removal of all trace of the injury; and recurrence of the inflammatory process should be especially avoided.

By the term *Ecchymosis* is understood, extravasation of blood beneath skin or mucous membrane; usually the result of slight bruise, or oblique wound; but sometimes unconnected with any external injury. It is amenable to the same treatment as ordinary bruise, on a reduced scale.

In connection with Bruise and Ecchymosis, see Taylor, and other authors on Medical Jurisprudence.

CHAPTER XXV.

SUSPENDED ANIMATION.

THIS may result from a variety of causes; and according to the nature of these will the surgeon's duties vary, in his attempt at resuscitation. In the emergency, there is but little time for thought or deliberation, and it behooves the practitioner to be at all times ready, bearing about with him distinct ideas of the cause of threatened death, as well as of the most likely means to avert that calamity.

1. *By Syncope;* from emotion, heat, bad air, or loss of blood. This has been already considered, in its nature and treatment (p. 321); the latter consisting mainly in attention to position, administering the ordinary stimuli, and, if need be, directly rousing the heart's action by galvanism. Recumbency, with lowering of the head, usually suffices.

2. *By Strangulation.* This acts destructively to life, through the trachea, veins, and brain. By injury to the first, asphyxia is produced; by venous obstruction, cerebral congestion results, and apoplexy may ensue; by concussion of the brain—in the case of a "drop"—more or less insensibility is at once established. And of these, the most important is the first. It is very seldom that displacement of the vertebræ takes place; only when the drop has been unusually great and violent.

The symptoms of strangulation, as observed in animals, are as follows:—the lips and face become discolored; the muscles are convulsed; those of respiration act more and more feebly; in less than two minutes they cease, the heart's action still maintaining the circulation for two or three minutes longer, and at length this too stops. Then death is complete, and recovery impossible.

Treatment resolves itself into simple indications: "1. If the ligature is removed before the efforts of the diaphragm have ceased, 'all that you have to do is to watch the patient carefully; if natural respiration continue, leave him to himself; if it cease, supply the want by inflating the lungs artificially.' 2. If the efforts of the diaphragm have already ceased, have recourse to artificial respiration without delay. There is no time to lose. In two or three minutes, after the last heave of the chest, the heart's action will have ceased, and then all hope is over. 3. In successful cases, so soon as normal respiration is established, inflation is desisted from. But treatment is not to cease. The patient is not safe. Dark blood has been circulating in the brain; and symptoms like those of poisoning by a narcotic may exist. Coma may remain. By and by the respiration may cease. Then has arrived a second period at which artificial respiration may be necessary to preserve life. And, in truth, the practitioner may expect to be called upon to inflate the lungs more frequently at this second period than at the first."[1]

To inflate the lungs, various methods may be adopted. The trachea may be opened, for more direct access; but that is unnecessary, unless some great injury have been done to the larynx, or unless the rima glottidis be otherwise insuperably obstructed—which it is not likely to be. In an emergency, no bellows, tube, or other inflating means may be at hand. In which case, let the forefinger of the left hand be thrust over the tongue, so as to hook up the epiglottis, and keep the rima open; then with the other hand, exert pressure on the chest, so as to produce alternate enlargement and diminution of its space. Or this latter part of the procedure may be intrusted to assistants. At the same time, inflation may be made through the nostril.

If an elastic tube is available, let that be passed by the nostril, either down to the throat, or lodged directly in the larynx; and through it let air be blown in, by bellows, or by mouth; subsequently expelling it again, by pressure on the chest. Or the nozzle of the bellows may be placed in the nostril, without any tube. Or, if no bellows can be got, a tube may be constructed efficiently enough, out of a roll of paper, parchment, card, or any similar substance. When bellows are employed, it is neither necessary nor advisable to shut the mouth and other nostril; these acting as safety valves, to prevent excessive insufflation, and injury to the lungs thereby. If there is no tube passing into the larynx, this must be pressed against the gullet, during use of the bellows; to prevent inflation of the stomach. Were this filled, descent of the diaphragm would be prevented, and no air could enter the lungs. The inflation is made gently, so as to avoid all risk or injury to the air-cells; and at proper intervals, so as to imitate the rhythm of natural respiration.

The patient having rallied, after-treatment may be required. Congestion may take place; and, to relieve this, it may be thought necessary to abstract blood. This, however, must always be done with caution, seeing that there can be but little tolerance of the remedy, in the yet enfeebled system. The patient should be kept in an atmosphere of moderately warm temperature, "to compensate for the insufficient generation of animal heat, which results from the impaired state of the functions of the brain, whether arising from the influence of a narcotic poison, or from another cause."

3. *By Immersion.* In drowning, death occurs as in strangulation, by want of aeration of the blood. "After immersion, a deep expiration takes place, by which bubbles of air are expelled from the lungs. Then comes an ineffectual effort to inspire; but water does not enter, instead of air; spasm of the muscles of the larynx seeming to prevent this. The attempts to breathe are repeated several times, and after each attempt a small quantity of air is expelled from the mouth and nostrils, until the air-cells of the lungs are almost completely emptied. Then insensibility occurs, and convulsive actions of the muscles mark the instant when the brain begins to suffer from the influx of the dark-colored blood. Soon all motion ceases; save in the thorax, where the heart may be felt yet

[1] British and Foreign Medical Review, No. xliii, p. 163.

feebly pulsating. Perhaps some further ineffectual efforts at respiration are resumed, and then all is still. The interval between cessation of respiratory effort and cessation of the heart's action, is brief in the case of strangulation; but it is still more brief in drowning. And the whole series of events, in the latter case, succeeding rapidly, are complete within a very few minutes."[1] All alleged facts to the contrary are justly held, by competent authorities,[2] to be apocryphal. "The time during which professed and accomplished divers are able to remain under water, probably never exceeds two minutes; although it may *seem* to be much longer. And the exaggeration of the time of submersion, by a bystander, in the case of either drowning or diving, may very readily be imagined to take place as it were involuntarily, without any intention to deceive; the observer being himself deceived as to the lapse of moments, by the multiplicity of events which have been crowded into them."[3]

Treatment of the Drowned. If the body be recovered before the diaphragm has ceased to act, respiration may be resumed naturally; if not, artificial inflation is to be employed, the mouth and fauces having been cleansed from all foreign matter. At the same time, warmth is applied; by means of the warm bath, dry heat, or friction; the first probably the best. Venesection is not indicated; neither is the use of stimuli—unless it be the application of galvanism to the heart, in circumstances otherwise desperate. The head and shoulders are raised; but it is not necessary to dangle and shake the body with the head down, with a view to extrusion of water from the stomach or lungs. After life has returned, cautious abstraction of blood may be necessary, to free the circulation; continuance of the stimuli being yet not interrupted.

The resuscitating means, begun without an instant's delay, are patiently persevered in so long as any reasonable expectation of success remains. If the submersion have been complete, and prolonged beyond four or five minutes, all efforts will probably prove in vain. Still, and under even more unpromising circumstances, it is right, for very obvious reasons, not to neglect a fair and reasonable trial of the restorative means.

4. *By Carbonic Acid, or other Poisonous Gases.* Here death is not purely by asphyxia, as in strangulation and immersion. Only two destructive gases—hydrogen and nitrogen—are said to be *negative* in their action. All the others are *positive;* exerting a distinctly poisonous effect, when received into the lungs. Of these, the two most apt to act injuriously on the human frame, in this double way—partly by suffocation, partly by poisoning—are *carbonic acid*, and *sulphuretted hydrogen;* administered either suicidally, or by accident. In the latter way, carbonic acid may be applied noxiously, or fatally, by confinement in an unventilated apartment; by sleeping in a confined room where charcoal is burning; by immersion in the gas extricated during fermentation; by

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[1] British and Foreign Medical Review, No. xliii, p. 164.

[2] "The cases which have been reported to the Royal Humane Society, of drowned persons who have been restored to life, when taken up cold and breathless after an immersion of half an hour, show that it is not travellers alone that are guilty of the vices of exaggeration and invention. We are compelled to regard these as mere extravagant fables, not more authentic, though certainly less poetical and elegant, than those of nymphs and mermaids, who reside in grottos beneath the waves of the sea, or than those Arabian fictions, which have astonished our youthful imaginations with the history of submarine nations whose princes dwell in palaces of crystal, at the bottom of the ocean."—SIR BENJAMIN BRODIE.

[3] British and Foreign Medical Review, No. xliii, p. 165.

exposure to the *choke-damp* of mines, cellars, wells, &c., or to the gas extricated in calcination of chalk or limestone. Sulphuretted hydrogen produces speedy death to those who are brought in contact with it, even when largely diluted by atmospheric air; as in drains and sewers. Inspired in its pure state, it is almost instantaneously fatal. Air slightly contaminated by it produces nausea, sickness, and general discomfort; which may be followed by quick pulse, hurried breathing, and delirium.

Treatment, in suspended animation from such causes, consists in cold affusion, stimulating embrocations to the chest and extremities, and artificial respiration. For the latter indication it is necessary to pass a tube through the glottis, which may be spasmodically closed. Failing in that, or no tube being at hand, laryngotomy will probably be necessary, so as to permit certain access of air to the lungs.

5. *By Lightning.* This seems to act chiefly on the brain and nervous system; producing symptoms, in those cases which are not immediately fatal, closely resembling those of concussion. When death is instantaneous, bruise, laceration, fracture, and scorching of the body may be found.

In the slighter cases, cold affusion will assist reaction. In the more severe examples, warmth to the surface will be necessary; with recourse to insufflation of the lungs, when natural respiration begins to flag.

6. *By Cold.* In this country, death from exposure to cold is usually associated with improper food and clothing, or with intemperance. Cold, however, when great or long continued, is quite sufficient of itself to extinguish life. Like the preceding, it seems to act mainly on the nervous system; producing giddiness, dimness of sight, feebleness and rigidity of the limbs, torpor, and profound sleep; during which state of lethargy, the vital functions gradually cease.

The curative indications are twofold. To restore circulation and sensibility; and yet to insure moderation in reaction, so as to prevent the fatal effects of its excess (p. 251). The body is rubbed first with snow—or cold water, if snow cannot be found—and afterwards with some dry soft substance. Then it is placed in a cool bed, in a room without a fire, while moderate friction, without any stimulant, is continued. A gently rousing enema—such as gruel, with a small quantity of turpentine—may then be administered; and, if the power of swallowing have been by this time regained, some simple nutriment, such as weak wine and water, may be given. Afterwards, support is administered very cautiously; always with a remembrance that rapid and excessive reaction must prove almost certainly fatal (p. 610).

7. *By Poisons.* The vast variety of poisonous substances, and the certainty with which many of them, if not counteracted, produce death, are known to all. The surgeon is often called upon to afford his aid, in evacuating the contents of the stomach; and that is most efficiently done by means of the stomach pump, as is explained in the "Practice" of Surgery. Should this instrument not be at hand, emesis may be produced by tickling the fauces; or by swallowing mustard, hot water, or—still better—sulphate of zinc.

Alison, Outlines of Pathology and Practice of Medicine, Edin. 1843; Christison on Poisons, Edin. 1845; Brodie, Lectures illustrative of various subjects in Pathology and Surgery, Lond. 1846; British and Foreign Review, No. xliii, p. 1600; Taylor, Medical Jurisprudence, Lond. 1846; Reid, Physiological and Pathological Observations, Edin. 1849.

CHAPTER XXVI.

ON ANÆSTHESIA, IN SURGERY.

The employment of anæsthesia in surgery is established; and, in this place, it is no longer necessary either to argue in its favor, or to trace the steps whereby it has become secure in public confidence. It is enough to advert briefly to the circumstances of its administration.

Chloroform and ether are the agents at present in use; and, in this country, the former is usually preferred. It should be of great purity.

The inhalation is managed cautiously, by an experienced hand; and in the important operations of surgery, during which the attention of the surgeon ought to be undistracted, and solely occupied with his operative work, it is essential to have an assistant to whom the charge of the anæsthetic process can be safely and wholly committed.

Usually no special instrument for administration is employed; it being found more simple and safe to use a handkerchief, or such like cloth, concavely arranged, and moderately saturated with the chloroform. The cloth is held near the mouth and nostrils, so as to insure full inhalation of the vapor, while at the same time a sufficient amount of atmospheric air has access, so as to prevent the risk of asphyxia.

Gentle, deep, regular inspirations are the best, in a passive state. And the patient is exempted from all noise and movement as much as possible.

No patient is proof against good chloroform well administered. Some require a much larger dose than others; but, sooner or later, all will succumb. In those who long resist, special care is necessary to watch the effects after a considerable quantity of the anæsthetic has been consumed.

The administrator, heeding only his own work, has a constant eye to the countenance, and a frequent hand upon the pulse. It is time for him to withdraw the agent, or diminish its dose—letting in more of the atmospheric air—when the pulse becomes very rapid and small, or very slow, or when the countenance is either convulsed or greatly congested.

Usually, there is a transition stage, in which the patient inclines to speak, laugh, sing, or articulate in some way, and muscular movement is considerable. The better the chloroform, the more rapidly inhaled, the quieter the room, the more likely is this stage to be quickly and favorably passed.

Then succeeds the condition of relaxation; evidenced by ste
breathing, fixedness of the eye, relaxation of all voluntary
insensibility to pain. This reached, the operator proceeds;

the operation, it is the business of the administrator to keep up this condition, by occasional reapplication of the chloroform from time to time; never allowing the patient to emerge, even imperfectly, from the state of impassivity and stupor.

This condition must be maintained with special care, in all operations which would otherwise prove very painful, necessarily imparting shock to the system; and also in those manipulations, as in the reduction of dislocations, in which absolute relaxation of the voluntary muscles is essential.

It is a condition very nearly allied to impending cessation of life. A patient so anæsthetized seems, to the uninitiated, to be absolutely *in articulo mortis*. Very little more would place the circumstances in a most critical relation. And two rules emerge accordingly:—1. Never to place the patient in that state, unless this be absolutely necessary, or at least highly expedient. 2. When the patient is in that state, let him be tended with the utmost solicitude and care.

If danger threaten—evidenced by the pulse, breathing, and countenance—the best restorative is free circulation of air around the patient with a securing of its access to the lungs; widening the circle of bystanders; opening the window; fanning the face; and, if need be, acting on the chest by compression, while the forefinger opens the patient's mouth, and hooks up the epiglottis. The giving of brandy, or other stimulus, by the mouth, is out of the question.

In minor operations—such as tooth pulling, evulsion of nails, opening of abscesses, extraction of foreign bodies, &c., where absolute impassivity is not required—deep stupor is not necessary. For it is found that though the operator in his manipulations may produce muscular movement, or cries indicative of pain, no pain is complained of, or indeed remembered, after all is over.

In emergence the patient is left to himself. But if progress is slow, this may be assisted by fanning the face, and occasionally sprinkling it with cold water.

If much chloroform have been given, vomiting may be expected. This is watched. The patient is turned upon his side, and care is taken that the windpipe is not filled or compressed with what is regurgitating past it.

In general, vomiting is to be avoided; and in some operations—as on the eye—its occurrence is especially untoward. The following are the best means of prevention:—pure chloroform, rapid induction, and a previously empty stomach. In a preconcerted operation, the patient should always, on this account, be fasting.

Should sickness or faintness continue to a troublesome degree, it may be necessary to administer wine, brandy, or other stimulus—cautiously.

The best condition, after emergence, is resumption of sleep; of a natural and tranquil kind. The patient, then, should be left undisturbed.

If pain necessarily continue, of a violent kind—as after ligature of rhoids—this may be greatly assuaged by a minor use of the chlo- atient whiffing it slightly, in a handkerchief, from time to

There are certain circumstances which either forbid the deep stupor of anæsthesia altogether, or require the agent to be managed with the extremest caution; as in disease of the heart with tendency to syncope, in tendency to congestion of the brain, in strongly marked hysteria, in operations on the mouth with risk of asphyxia from blood accumulating in the air-passages. These matters, however, with many others, will fall to be discussed each in its proper place, throughout the details of the Practice of Surgery.

Vide the Appendix to the former edition of this work; also on the Inhalation of Ether in Surgical Operations, &c. by John Snow, M.D., Lond. 1847, and later editions; Anæsthesia, or the Employment of Chloroform and Ether in Surgery, &c., by J. Y. Simpson, M.D., Edin. 1849; Surgical Experience of Chloroform, by J. Miller, Edin. 1848; North British Review, May. 1847, p. 169, &c, &c.

APPENDIX.

HISTORICAL NOTICE
OF
SURGERY.

APPENDIX.

HISTORICAL NOTICE OF SURGERY.[1]

THE term *Surgery*, or *Chirurgery*, from χειρ, *the hand*, and εργον, *work*, originally signified, as its derivation implies, the manual procedure, by means of instruments or otherwise, directed towards the repair of injury and the cure of disease; in contradistinction to the practice of *Medicine*, which denotes the treatment of disease by the administration of drugs, or other substances supposed to be of a sanative tendency. Such a meagre description applied but too justly to surgery in its infancy, and still more after separation from its twin-sister medicine, in the twelfth century. When its practice was denounced by the Council of Tours as derogatory to the dignity of the sacred office of the priesthood, and beneath the attention of all men of learning, the term chirurgery, in its most literal interpretation, was quite sufficient to comprehend the duties of the degraded and uninformed surgeon; who had degenerated into a mere mechanic, attached to, and completely dependent on, the learned and philosophic physician. But the matured progress of the healing art, fortunately for science and humanity, has rendered such a definition of surgery in these days utterly untenable. Its complete separation from medicine would now be attended with the utmost difficulty; nor is it desirable that the attempt should be made, because its success, however partial and imperfect, would be most hurtful to both. They are now, and it is to be hoped will ever remain, one and inseparable. Their principles are the same throughout, and the exercise of their different branches requires the same fundamental knowledge; but their details are so numerous and intricate as to render it most difficult, if not impossible, for any one individual to cultivate all with equal success. The consequence has been, that while the theory and principles of physic and surgery remain united, as constituting one and the same science, the practical parts are now frequently separated into distinct professions; each person adopting that department most congenial to his pursuits, and for the management of which he conceives himself best qualified. The separation, however, is not one of acquirements, but merely of practice. It should never be forgotten, that the physician, before he can be either accomplished or successful in his profession, must be intimately conversant with the principles, if not with the practice of surgery. And most certainly, no one can ever lay just claim even to the title of surgeon, far less hope for eminence or success, unless he be equally qualified to assume both the appellation and the employment of the physician.

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[1] Originally contributed by the Author to the last edition of the Encyclopædia Britannica.

Many and labored have been the attempts to define surgery according to its present state, so as to prevent interference with the department of physic. This example we will not follow. The arrangement as to what is medical, and what surgical, must, in a great measure, depend on custom, not on fixed and permanent rules. The paths of the practical surgeon and physician are distinct; but in their course they must often cross each other. And these collisions, so far from being avoided, ought rather to be sought, as probable sources of mutual benefit; so long as those enlightened feelings are entertained, and that honorable conduct pursued, which ought ever to distinguish the followers of a liberal, useful, and learned profession.

That surgery is as old as man himself, that it was coeval with his fallen state, there can be little doubt. The fall entailed frequent reception of injury by external violence; and to assuage their pain and remove their inconvenience, the ingenuity and contrivance of the sufferer were, doubtless, powerfully excited. Thus it would seem that, as to antiquity of origin, surgery must take precedence of medicine. And after wars and dissensions began to prevail, and wounds and injuries became both more frequent and more deadly, it is most probable that to these the practitioners of the healing art alone directed their attention; before the nature of disease began to be understood, or its cure was supposed to be within the reach of human means.

As to the state of surgery among the early Egyptians, we know but little; except that it was customary, in the time of Joseph, to embalm the dead—a process which appertains closely to both medicine and surgery. There are some grounds, however, for suspecting that they were more conversant with surgery than is generally supposed; for it is said that on "the ruined walls of the renowned temples of ancient Thebes, basso-relievos have been found, displaying surgical operations, and instruments not far different from some in use in modern times." Their medical practice, entirely founded on incantation and astrology, was sufficiently simple. They divided the body into thirty-six parts, believing in an equal number of demons, to whom those parts were intrusted; and to invoke whose aid in sickness was the principal duty of the physician, each spirit being called upon to cure his own peculiar portion.

Among the Jews, the operation of circumcision was performed, no doubt skilfully and dexterously, though with rude implements, by the priesthood; an order which, for many ages, and in many climes, conjoined cure of the body with that of the soul.

The earliest notice of our art is from the ancient Greeks; who, it is probable, had derived their medical traditions from the Egyptians. They considered medicine to be of Divine origin; and its first professors, as they inform us, were no less personages than gods and sons of gods.

Medicine and surgery, at their birth, were conjoined; and both continued to be practised indiscriminately, until separated by the Arabian school. Their complete estrangement occurred, as we have already stated, about the middle of the twelfth century. At first, surgery chiefly occupied the attention of the ancient leech, as the more certain and more obviously useful branch of his profession; but ultimately it became very secondary to medicine, when dignified by philosophy and priestcraft.

Chiron the Centaur, born in Thessaly, is presumed to have been the father of surgery; celebrated for skilfully applying soothing herbs to wounds and bruises. But his fame is somewhat endangered by that of Æsculapius, the son of Apollo; by some held to be the pupil of Chiron, by others, his predecessor and superior.

Æsculapius is supposed to have been deified, on account of his skill, about fifty years before the Trojan war. His very existence, however, has been questioned. Apollo was the original god of physic among the early Greeks; but he appears to have resigned in favor of Esculapius, whose temples became the depositories of medical and surgical knowledge; more particularly those of Epidaurus, Cnidos, Cos, and Pergamus.

Certain it is, according to the testimony of Celsus, that Æsculapius is the most ancient authority in surgery. His immediate descendants, two sons, Podalirius and Machaon, have been immortalized by Homer. They followed Agamemnon to the Trojan war (B. C. 1192), and there their services were so highly valued as to secure them a not unconspicuous niche among the heroes of the Iliad. Of the two, Machaon seems to have been the more distinguished. When he is wounded by Paris, the whole army is represented as interested in his recovery. Even the stern Achilles inquires anxiously after "the wounded offspring of the healing god;" and the valiant Nestor, to whose care he is intrusted, is exhorted to unwonted exertion in his behalf; "for a leech who, like him, knows how to cut out darts, and relieve the smarting of wounds, by soothing unguents, is to armies more in value than many other heroes." Podalirius enjoys the distinction of being reputed the first of phlebotomists, and probably the most successful, from his time to this; having opened a vein in either arm of the King of Caria's daughter, who had been severely injured by a fall from the house-top; having, after her recovery been rewarded with the hand of the fair princess; and having been presented by her munificent father with the Chersonese as her dowry. As to medicine, they seem to have been either ignorant, or in no great repute; for, on the breaking out of pestilence in the Grecian camp, Homer neglects them entirely, and applies at once to Apollo. And even their surgical attainments, for which they are celebrated by him, seemed to have extended no farther than to the simple extraction of darts and other offensive weapons, the checking of hemorrhage by styptics or pressure, and the application of lenitive salves. The poet takes notice of his warriors sustaining fracture of the bones; but in such emergencies he adopts the same course as in the pestilence, and invokes the aid of the non-professional deities; from which circumstance we may infer, that in those days surgery had made but little advancement.

For upwards of 600 years after the Trojan war, there are scarcely any accounts of medicine and surgery. They seem to have remained strangely stationary during the whole of that period. Their practice was confined to the Asclepiades, or reputed descendants of Æsculapius; whose lore was orally communicated from father to son in that family, until an extraordinary impulse was received from the great Hippocrates—himself a branch of the family, and said to have been the fiftieth in lineal descent from the deified founder. The Asclepiades, in the course of their monopoly, established three schools of medicine: at Rhodes, at Cnidos, and at Cos. The last gave Hippocrates to the world, and thus attained a proud and enduring pre-eminence.

Pythagoras (B. C. 600) was the first who brought philosophy to bear upon the practice of the healing art, and led the way in raising it to the dignity of a science. Democritus, the happy sage, likewise turned his attention to medicine as a branch of general philosophy, and pursued it zealously. He lived in terms of friendship with Hippocrates, by whom he was held in great respect. By Pythagoras a school at Crotona was founded, about the time of Tarquinius Superbus; espousing doctrines somewhat different from those of Cos and Cnidos. It produced Damocedes, a contemporary of Pythagoras; who seems to have practised in Athens, an honored and successful surgeon. By Polycrates, King of Samos, he was presented with two talents of gold for having cured him of a troublesome distemper. He was afterwards taken captive by the Persians. Their king, Darius, was intrusted to his care for a dislocated ankle, as well as the queen, Atossa, for a cancer of the breast; and he was soon loaded with honor and wealth, on account of his wonderful cures, performed after the Egyptian physicians, previously in attendance, had signally failed.

But we cannot suppose such men as Damocedes and the Asclepiades to have attained any great proficiency in surgery; for the touch of a dead body was interdicted as a profanation both by Jew and Greek, and consequently they must have been almost entirely ignorant of anatomy. They may have understood something of the skeleton, from their practice among fractures and dislocations; and they may have formed some general idea of the viscera, from researches in comparative anatomy, and from instruction by the Egyptians, whose practice in embalming afforded ample scope for observation. But the minute structure of the human body must have been to them a profound mystery. And, knowing that anatomy is, was, and ever must be the foundation of true surgical knowledge, we cannot evade the conviction that surgery, though occasionally successful and honored in ancient times, must have been nothing more than a rude, imperfect, and uncertain art. The practice of its professors, seems to have been extremely limited; consisting of little more than the binding up of wounds, and the stanching of hemorrhage by styptics and the cautery; the extraction of darts and other missiles from the wounds which they had inflicted; phlebotomy, both general and local; and cupping by scarification. Whether they practised the capital operations or not, we are not informed; but it is probable that their comparative ignorance of anatomy effectually deterred them from any extensive division of the soft parts, as extremely hazardous and uncertain.

Hippocrates, born in the 80th Olympiad, upwards of 400 years before
the Christian era, did more for medicine and surgery ho had
preceded him; and indeed few of those who have been
of equal service to the profession. He soon f great

measure from the absurdities with which ignorance and superstition had invested it; and through a long, honored, and glorious life, he set a splendid example of persevering industry, philosophical research, and high moral worth. His fame soon raised the Coan school far above its rivals. Though his anatomical knowledge seems little better than a blending of ingenuity with error, yet he appears to have had some indistinct notions of the circulation of the blood; although Dr. Pitcairne, in his "Solutio Problematis de Inventoribus," has sufficiently evinced that he was very far from anticipating the great discovery of Harvey. With all his deficiencies, and notwithstanding all the disadvantages under which he labored, so correct was his observation, and so faithful his chronicling of disease, that many of his descriptions may be fairly inserted in our modern nosologies. Though his attention was chiefly directed towards the improvement and promotion of physic, now begirt with philosophy, and studied as a science; and though his practice was principally confined to the treatment of internal disease, yet he was not wholly inattentive to surgery. And his practice seems to have been tolerably bold and decisive. For, in regard to external disease, it was with him a maxim, that "when medicine failed, recourse should be had to the knife, and when the knife was unsuccessful, to fire;" a remedy of which all the ancient doctors seem to have been particularly fond, from Prometheus downwards. Hippocrates employed it not only in a variety of diseases, but in various forms. Sometimes he applied red-hot irons to the part; sometimes he raised a conflagration on it, and of it, by a piece of wood dipped in boiling oil, or by burning a roll of flax after the manner of the modern moxa. He also made use of tents and issues, as more gentle means of counter-irritation. He seems to have performed the capital operations with boldness and success; excepting lithotomy, the practice of which appears to have been confined to a few who made it their exclusive study. He, however, recommends the removal of calculus, when large and firmly lodged in the kidney, by incision; adding, probably, in apology for the daring of the procedure, that otherwise there are no hopes of a cure, and that the disease must prove fatal. He reduced dislocations, and set fractures, but clumsily and cruelly; extracted the fœtus with forceps, when necessary; and both used and abused the trepan, employing it not only in depression and other accidents of the cranium, but also in cases of headache, and other affections, to which the operation is inapplicable. In cases of empyema and hydrothorax, after ascertaining by percussion that fluid was present in the cavity of the chest, he did not hesitate to make an incision between the ribs; having allowed part of the fluid to escape, he placed a tent in the wound; and by withdrawing it regularly once a day, the whole was ultimately evacuated. He seems to have been perfectly acquainted with tetanus and spontaneous gangrene; observing, that even minute wounds of tendinous parts, as the fingers and toes, sometimes produce convulsions which terminate fatally; and that black spots on the feet frequently increase to extensive gangrene, and incur-
le mortifications. Some of his practices have been long and justly
ded; some have been successfully continued; and others have,
disuse, been revived as modern inventions. For example, his me-
of ascertaining the presence or absence of fluid in the chest was

by percussion, and applying the ear to the part; thus foreshadowing the use of the modern stethoscope. One of his modes of counter-irritation, we have seen, was by burning flax on the part as in the modern moxa. And he strongly recommends the production of eschars on the back and breast in the earlier stages of pulmonary disease; thus anticipating the supposed valuable discoveries of a celebrated modern charlatan. His writings are elegant, and well repay a careful perusal. By them he made posterity his debtor. But his contemporaries were not insensible to his merits; and endeavored to reward them during his life. The inhabitants of Argos voted him a statue of gold; he was more than once crowned by the Athenians; and, though a stranger, was initiated into the most sacred mysteries of their religion—the highest distinction which they could confer. After his death, universal and almost divine honors were paid to his memory; temples were erected to him, and his altars covered with offerings.

We have already seen that surgery had long been stationary before the time of Hippocrates; and it made but little advancement during many succeeding generations. The Asclepiades had confined the knowledge of medicine among themselves. Hippocrates, however, gave oral instructions in anatomy, and the art of healing; and thus disclosed its mysteries to the world. But few of his disciples seem to have profited much by his liberality. One of them, his kinsman Ctesias, we are told, acquired considerable renown for his skill; and having been taken prisoner by Artaxerxes Mnemon, in a battle fought against his brother Cyrus, was successful in curing him of a severe wound, and thus obtained favor with his captor.

Plato began to flourish about this time (B. C. 370). But though he was connected with medicine, we cannot lay claim to him as eminent in surgery; and he was more famous for his philosophy than his physic. Perhaps the most distinguished in surgery, among the more immediate successors of Hippocrates, was Diocles Carystus. He devoted more attention to anatomy than any of his predecessors; was curious in bandaging wounds of the head; and invented the bellulon, an instrument for extracting darts. Carrying his surgery into the practice of medicine, he was not very happy in the result. From observing that external wounds, abscesses, and inflammations, were attended with fever, he supposed that general fever was uniformly occasioned by one or more of these causes operating internally. He followed Hippocrates in practice, and, like him, cultivated his profession, "not for lucre or vainglory, but from real love of the medical art, and a pure spirit of humanity."

Praxagoras of Cos was the last of the Asclepiades who succeeded in leaving a name behind him. As a surgeon he is reported to have been bold in the extreme; incising the fauces freely, and excising portions of the soft palate, in bad cases of cynanche; and making incisions into the bowels to remove obstructions, when milder measures failed. He is said to have been the first to distinguish between arteries and veins, and to observe the pulse as an index of the general system.

Aristotle, the celebrated preceptor of Alexander the Great, although not strictly in the medical profession, was the promulgator of doctrines which for a long time had a powerful effect on medicine. While he followed out the general principles of the healing art, and was curious in anatomical research—giving the aorta its name, and showing that all bloodvessels centre in the heart—he seems to have disdained to meddle with the practical details, and among the rest those of surgery.

On dismemberment of the vast empire of Macedonia, after the death of Alexander the Great, learning took up its chief abode at Alexandria, under the protection of Ptolemy Soter (B. C. 300). And here it was that popular prejudice first gave way, and permitted the examination of dead bodies; the greatest possible boon to the medical profession, inasmuch as it removed what had hitherto been the most serious obstacle to its advancement—ignorance of human anatomy. Herophilus and Erasistratus, the two great heads of the Egyptian medical school, were the first who had an opportunity of practising human dissection; the bodies of criminals having been given to them for that purpose. And they consequently, not only corrected many errors, but made numerous and important discoveries in anatomy; thus imparting a fresh stimulus, and affording a new and more solid basis, to both medicine and surgery. By some they have been accused of carrying their enthusiasm, in this inquiry, to such an extent as to "open the bodies of living criminals, for the furtherance of their physiological views." This, however, is probably a mere exaggeration; originating in the horror with which human dissection was at first regarded.

We find even these privileged men falling into most palpable mistakes. For example, Herophilus plainly confounds the tendons and ligaments with the nerves. Yet the fact that the names which he gave, to many parts, still remain in use, will of itself remind posterity how much they are indebted to him for his anatomical labors. He was likewise one of the greatest surgeons of ancient times; and, as well as Erasistratus, acquired as much fame for brilliant cures as for anatomical knowledge. The surgical practice of the latter was characterized by peculiar boldness and decision, and strongly marked with the failing of his time and school; a love of multiplying and inventing murderous implements, and a relentless use of them. "In schirrosities and tumors of the liver, he did not scruple to make an ample division of the integuments, and try applications to that viscus itself. He followed the same practice in diseases of the spleen; which he regarded as of little consequence in the animal economy." And perhaps he was right in his supposition, though not in his practice. In cases of retention of urine, he made use of the particular catheter which long bore his name.

Xenophon of Cos, said to have been a follower of Erasistratus, seems to have been among the first who arrested hemorrhage from a member, by encircling it tightly with a ligature. Mantius, a pupil of Herophilus, wrote a treatise on surgical dressings, which he rendered complicated in the extreme. Another, Andreas of Carystus, wrote on the union of fractured bones, and invented several ponderous machines for reducing luxations of the femur. Indeed, the surgeons of the Alexandrian school were all distinguished by the nicety and complexity of their dressings and bandagings; of which they invented a great variety. Among them, as in the time of Hippocrates, lithotomy was practised by particular individuals, who devoted themselves exclusively to that operation. And we are told that one of them, Ammonius, employed an instrument, by means of which he broke down stones in the bladder; plainly anticipating Civiale, and furnishing a marked example to the present age of the truth of Solomon's apophthegm, that "there is nothing new under the sun."[1] It is not improbable that some of their other practices might have afforded equally striking examples of this sometimes unpalatable truth. But unfortunately the greater part of the writings of the Alexandrian school perished in the conflagration of the famous national library, in the time of Julius Cæsar; a calamity fraught with immense loss to the healing art, as well as to almost every other branch of knowledge.

The arts and sciences followed the seat of empire, in its transfer to Europe under Julius Cæsar; and Rome became the grand centre of intellectual illumination. Notwithstanding the shrewd sense displayed by the ancient Romans in most matters, it is strange, yet true, that for centuries all ranks of society, from the mere plebeian rabble to the censor, had entertained an abhorrence of practitioners of medicine and surgery, and trusted for cures to spells and incantations. Indeed, public edicts were issued, "discouraging all countenance to the professed exercise of physic, and recommending faith in traditionary prescriptions and religious rites." Cato the censor managed the sick of his own family according to the terms of this edict, and gravely wrote down the words of incantation for curing dislocation or fracture. For nearly the first six hundred years of its existence, Rome, accordingly, had no regular practitioner of medicine. The first we read of was Archagathus, a Greek, from the Alexandrian school; who practised in Rome, chiefly as a surgeon, during the consulates of Lucius Æmilius and Marcus Livius. At first, his surgical skill obtained for him no inconsiderable fame; but the ancient prejudice soon revived in full vigor. An enraged populace—perhaps not without some reason, for he seems to have been particularly fond of the knife and cautery—compelled him not only to suspend his practice; but, changing his original title of "healer of wounds" to that of "executioner," caused him to be banished from the Roman capital. Afterwards, however, a native of Bithynia, assuming the name of Asclepiades (B. C. 96), established himself in tolerable repute; by virtue of insinuating manners, shrewd common sense, and the performance of several fortunate cures "*tuto, cito, et jucunde.*" But with him we have little concern. For his sagacity soon taught him, that it was essential to his welfare to avoid the unpopular practice of surgical operations; and, accordingly, he confined himself entirely to the apparently less hurtful administration of medicine. The only important traces of his surgical practice are, that in ascites he practised and recommended discharge of the accumulated fluid, by minute punctures of the abdominal parietes; and that for quinsy, which term probably comprehended many of the various acute diseases of the throat now known and distinguished, he not only employed bold bloodletting, local and general, by the lancet and by cupping, but also had recourse to scarification of the fauces, and even attempted laryngotomy. By novel and successful cures in his medical practice, and frequent indulgence in skilful quackery, he obtained great personal reputation; and so far overcame popular prejudice, as to establish a tolerably fair field in Rome for future practitioners. He was the contemporary of Cæsar, and the personal friend of Cicero. The latter is eloquent in his praise; and, through him, seems to have formed a high estimate of the medical character. "Nothing," says he, "brings men nearer to the gods, than by giving health to their fellow-creatures." And it would thus seem that, in his time at least, the ancient grudge against the doctors had abated in Rome.

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[1] A curious illustration of this is given by Dr. James Johnson, in the narrative of his visit to Pompeii. "The Dilator or Speculum, for which Mr. Weiss of the Strand obtained so much repute a few years ago, has its exact prototype in the Bourbon Museum at Naples. The coincidence in such an ingenious contrivance would be absolutely miraculous; but unfortunately there is a key to the similitude, which destroys the charm of astonishment. A crafty Frenchman imitated from memory, and with some awkward deviations, the Pompeian Speculum, and passed it off as his own. Weiss improved upon the Frenchman, and hit upon the exact construction of the original! Many modern discoveries may probably have originated in the same way."

Among the disciples and immediate followers of Asclepiades, was Cassius, described as Iatro-Sophista; who left behind him several works on anatomical and surgical subjects. In one of the latter, he distinctly accounts for injuries on one side of the head producing paralysis on the other, from decussation of the nervous fibres; a tolerable proof that he was not only a good anatomist for the time, but also an observant practitioner.

Rome itself did not produce a single medical practitioner of any reputation, before the age of Aulus Cornelius Celsus; although he himself chooses to be complimentary to some of his immediate predecessors, "Tryphon, Euelpistus, and Meges, the most learned of them all. Celsus, the contemporary of Horace, Virgil, and Ovid, likened to Hippocrates for the quantity of his sound practical information, and to Cicero for the elegance of his style, lived in the reigns of Tiberius, Caligula, Claudius, and Nero; in the beginning of the first century of Christianity, upwards of a hundred and fifty years before Galen."[1] In his celebrated medical work, he places great reliance on Hippocrates and Asclepiades, more particularly the latter, and gives a complete and excellent digest of all the true medical and surgical knowledge of his times; although it is not certain that he himself either practised medicine or operated in surgery. "Of his surgical operations and remarks, many are yet far from being obsolete, and impress us with a high idea of his ingenuity and judgment. His mode of performing lithotomy (on the gripe), has been in recent times warmly defended by Heister, especially as applicable to children. He describes the operation for cataract by depression, and the method of forming an artificial pupil. The whole of his account of injuries of the head is admirable, and evinces wonderful tact and discrimination. His rules for distinguishing fracture, and for the application of the trepan, have been highly eulogised; nor is what he says about contrecoups less accurate. He is the first who has remarked that there may be rupture of a vessel within the cranium without fracture or depression." And he is the first who recommended the application of ligatures to a wounded artery, with a view of arresting its hemorrhage, after pressure has failed. He improved amputation, an operation then not much in use; and recommended its adoption in cases of gangrene from external causes. He is minute in his details as to the treatment of fracture and dislocation. His description of carbuncle is good, and its treatment similar to that now pursued; namely, free application of the strongest escharotics to the gangrened part. He describes several species of hernia, and gives directions for their reduction; and also mentions the operation for hare-lip. "It would be endless, however, to particularize. Whoever wishes to know the exact state of surgical knowledge in the world at the time of the Cæsars, may turn to the pages of Celsus, with hopes of gratification which will not be disappointed."

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[1] A Life of Celsus by Joannes Rhodius is subjoined to a second edition of a work of that learned Dane, entitled "De Acia Dissertatio ad Cornelii Celsi mentem, qua simul universæ Fibulæ ratio explicatur." Hafniæ, 1672, 4to. We must likewise refer our philological readers to "Jo. Baptistæ Morgagni in Aur. Corn. Celsum et Q. Ser. Samonicum Epistolæ, in quibus de utriusque Auctoris variis Editionibus, Libris quoque manuscriptis, et Commentatoribus disseritur." Hagæ-Com. 1734, 4to. The prænomen of Celsus appears to have been Aulus, [redacted] Aurelius, which is a "nomen gentile." See Fabricii Bibliotheca Latina, tom. ii, p.

He relates an interesting anecdote of Hippocrates, illustrative of his abuse of the trepan. "Knowing and skilful as he was, he once mistook a fracture of the skull for a natural suture; and was afterwards so ingenuous as to confess his mistake, and leave it on record." To this he adds, "This was acting like a truly great man. Little geniuses, conscious to themselves that they have nothing to spare, cannot bear the least diminution of their prerogative, nor suffer themselves to depart from any opinion which they have embraced, how false and pernicious soever that opinion may be; while the man of real ability is always ready to make a frank acknowledgment of his errors, especially in a profession where it is of importance to posterity to read the truth;" a moral which cannot be too often forced upon our attention.

Aretæus, born in Cappadocia, practised in Rome, probably about the time of Domitian (A. D. 50–80). He was the first who made use of blisters; using cantharides for that purpose. He brought the operation of bronchotomy into disuse; conceiving that the untoward symptoms of suffocation were increased thereby, and that the wound was incapable of healing. Dissection in his time was prohibited under the severest penalties. His anatomical knowledge was therefore neither profound nor exact; "nevertheless, he had the sound penetration to regard anatomy as the only legitimate basis on which either medical or surgical science could rest." Rufus, the Ephesian, who seems to have lived in the time of the Emperor Trajan (A. D. 96–117), was a zealous anatomist and surgeon; and has left a treatise on disease of the kidneys and bladder. He tied an artery which had been wounded in venesection and become aneurismal, at the bend of the arm. From the time of Celsus, the aneurismal formations, if treated at all, had hitherto been attacked exclusively by incision, and the actual cautery.

Heliodorus, the celebrated physician of Trajan, has left some excellent observations on injuries of the head. Antyllus, by some said to have been almost a contemporary, by others not to have flourished till A. D. 340, was a zealous and successful surgeon. He boldly recommends bronchotomy, in cases of threatened suffocation induced by disease of the throat; and, in inflammatory affections of emergency, advises arteriotomy in preference to venesection, showing that excessive loss of blood thereby need not be dreaded—being readily prevented by dividing the artery completely across. He continued the use of ligature, in the operation for aneurism, begun by Rufus; his method being to tie the artery above and below the tumor; then to incise the cyst, and procure its closure by granulation. He also alludes to the operation for cataract by extraction; which he, however, recommends very cautiously, and only when the cataract is small. He obtained the radical cure of hydrocele, by free incision of the parts.

About the commencement of the second century, Archigenes the Syrian settled in Rome; and distinguished himself in both medicine and surgery. His writings, which were chiefly confined to the latter subject, are unfortunately lost. Between Celsus and Galen, however, we meet with no great Roman writer on medicine or surgery. These were among the last of the liberal arts that were encouraged by the Romans; and the proud patricians refusing to educate any of their family in such a profession, the medical practitioners of Rome were at first importations from Greece and Alexandria, and afterwards self-educated slaves and freedmen.[1]

Claudius Galenus was born at Pergamus, in Asia Minor, in the 131st year of the Christian era. After studying at Smyrna and Corinth, he completed his medical education at Alexandria, and ultimately settled in Rome; where he soon obtained a great reputation, both as a successful practitioner and as a public lecturer on anatomy. Professional jealousy of his talents, however, drove him from Rome; to which he did not return until recalled by Marcus Aurelius. Shortly afterwards, he was appointed physician to the young emperor Commodus; with whom, as well as with the public, he rose to great favor. A man of great erudition, brilliant genius, and indomitable industry, he produced works which exerted a most powerful and extensive influence over medical practice. He has the merit of rescuing medical inquiry from the chaos in which he found it, and restoring it to the paths of light and nature. His fame indeed was so great as to prove, in one sense, detrimental to the advancement of the medical profession: inasmuch as his opinions were received as oracular in the schools of all the civilized countries, for no less a period than 1300 years; thus seriously retarding further investigation. His works were both numerous and elaborate; but, unfortunately, he seems to have been debarred from the study of the groundwork of his profession, human anatomy. His dissections appear to have been limited to the simiæ and other mammiferous animals, as most resembling the human structure; though on one occasion "he felicitates himself on the opportunities he had enjoyed of examining two skeletons preserved in Alexandria, and recommends all anxious to obtain a thorough knowledge of osteology to repair to that city." In his early years he practised surgery at Pergamus with marked success. But, in Rome, he seems to have confined himself almost entirely to medicine; excepting the occasional performance of phlebotomy. Probably the valorous Romans had not yet lost their hatred and dread of the terrible operations of surgery. Like others, however, he was still so much of a general practitioner, as to practise pharmacy as well as medicine, with a little of surgery: and he himself informs us, that he had a drug-shop in the Via Sacra. "He established two general principles as the basis of all surgery; synthesis, or the reunion of the parts; diæresis, or their complete division, as by amputation or extirpation. In four cases he detected luxation of the femur backwards, a variety not mentioned by Hippocrates; and records two instances of spontaneous luxation of the same bone. He also treats of more than one species of hernia. But although in his writings we meet with a few bold chirurgical attempts, as in the application of the trepan to the sternum in a case of empyema; yet it must be confessed, that by far the greatest part of his surgery seems to have been confined to fomentations, ointments, and plasters, for external affections; together with the art of bandaging, a love for which he necessarily acquired at the Alexandrian schools; and the employment of complicated machinery in fracture and dislocations." His researches were not limited to medical science, but comprehended literature and philosophy.[1]

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[1] On this subject, a remarkable controversy took place in England during the earlier part
[redacted] It was occasioned by Dr. Mead's "Oratio Anniversaria Harveiana, in
dicorum Londinensium Collegii habita ad diem XVIII, Octobris MDCCXXIII.
rtatio de Nummis quibusdam a Smyrnæis in Medicorum honorem per-
724, 4to. This was followed by a publication of Dr. Middleton, "De Me-
eres Romanos Degentium Conditione Dissertatio; qua, contra viros cele-
Sponium et Richardum Meadium, servilem atque ignobilem eam fuisse
b, 1726, 4to. To this dissertation Dr. Ward of Gresham College, pub-
1727: Middleton published the first part of a defence in 1728, and Ward
the course of the same year, his antagonist prepared a second part, of
printed a few copies in 1761, eleven years after the author's death.

The early Christians are alleged to have unfortunately injured medicine and surgery, by attributing to martyrs and their relics the power of healing wounds and curing diseases; "acknowledging the active interference of demons and blessed spirits in the affairs of men, and leaving true philosophy in total abandonment."

A Cimmerian gloom was now fast overspreading the world, by which science and art were destined to be long obscured; and, shortly after the time of Galen, we accordingly find the medical, along with the other sciences, encompassed by the dark clouds of ignorance and barbarism. One or two names, however, occur worthy of notice; but more from having preserved than advanced medical knowledge. Oribasius, a pupil of Zeno, lived in the time of the Emperor Julian (A.D. 350), whose friendship he enjoyed; and became a celebrated practitioner, as well as of great importance in the state. His works are principally compilations, though judicious and useful. His surgery is marked with timidity; discouraging operations, except in most extreme cases; and is chiefly confined to unguents and embrocations. He abstracted blood locally, by making deep and extensive scarifications, or rather incisions, with a knife; a proceeding somewhat resembling the important modern improvement in the treatment of erysipelas, but adopted under different circumstances, and with other objects in view.

During the fifth century, the West was repeatedly invaded by the Huns,

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[1] Here we must refer our classical readers to a most important collection published under the title of "Medicorum Græcorum Opera quæ exstant. Editionem curavit D. Carolus Gottlob Kuhn, Professor Physiologiæ et Pathologiæ in Literarum Universitate Lipsiensi Publicus Ordinarius." Lipsiæ, 1821–30, 26 tom. 8vo. Three of the volumes are each divided into two parts. This collection includes the works of Hippocrates, Aretæus, Dioscorides, and Galen. Dioscorides was edited by Sprengel, and the other writers by Kuhn.

Goths, Alans, and Lombards. Science greatly suffered in consequence; and no name worthy of remembrance is to be found, until, about two centuries after Oribasius, appeared Aëtius (A.D. 550), a native of Amida, and a pupil of the Alexandrian school. "His surgical writings are copious and valuable. His opinions were guided by experience, and his methods of management and cure are characterized by much caution and discrimination. We find a variety of surgical queries and suggestions, which had escaped Celsus and Galen; as well as the description of several diseases which have been omitted by Paulus Ægineta. He recommended and practised scarification of the legs in anasarca; and made free use of both the actual and potential cauteries. He cut out hemorrhoidal tumors; operated for aneurism; tried to dissolve urinary calculi, by the administration of internal remedies; and has given a series of interesting chapters on inflammation of the intestines followed by abscess, on encysted tumors, on the varieties of hernia, on diseases of the testicle and castration, on the pricks of the nerves and tendons, and, in fact, on almost every important branch of surgical knowledge. If, mixed up with these, we find some things which the matured experience of ages has abolished, it is less to be marvelled at, than that surgery was already enriched with so many valuable facts and observations." He makes no reference to the reduction of fractures and dislocations, whence it has been plausibly inferred, "that in all likelihood quacks were at that time in complete possession of this branch of practice. Better were it for society that it was quite out of their hands now!" He seems to have been the first to open up a field of medical inquiry, which has since been so successfully cultivated—the nature and composition of urinary calculi. He appears also to have turned much of his attention to diseases of the eye; and is the first who speaks of the dracunculus or Guinea worm.

Alexander of Trallis, a famous physician in the time of Justinian, about the middle of the sixth century, was an author of more originality than either Oribasius or Aëtius. He wrote on diseases of the eye, and on fracture. But both treatises have been lost; which is the more to be regretted, as, with this exception, he confined himself entirely to internal disease.

The celebrated Paulus Ægineta, also of the Alexandrian school, lived about the middle of the seventh century, and made both large and valuable contributions to surgery. He frequently performed the operations which he describes; and abandoned the labors of the mere theorist, for the more valuable results of practical observation and experience. "His sixth book has been considered by many, and not without reason, as the best body of surgical knowledge, previous to the revival of letters." He recommended bleeding from the immediate neighborhood of the part affected, in preference to general bloodletting, because more effectual; and, for the like reason, opened the temporal artery in cases of very severe ophthalmia. He had recourse to copious venesection, with the view of accelerating painful descent of calculus in the ureter. He opened internal abscesses by caustics, and defined the points at which he thought it advisable to perform paracentesis in the different alleged species of ascites. In lithotomy, having first endeavored to ascertain the situation of the calculus by the rectum, he made his incision, not in the centre of the perineum, as recommended by Celsus, but to one side of the raphe, as is now practised. Of the impropriety of extensive incision of the bladder, he seems to have been well aware; directing that the external wound should be much freer than the internal, and that the latter should be in extent merely sufficient to permit the passage of the stone. While Celsus limited the operation to patients between nine and fourteen years of age, he sanctions its performance after the age of puberty; but admits that the chances of success increase with the youth of the patient. He described more than one variety of aneurism, pointing out those cases in which he thought it advisable to attempt a cure by operation; and extended this to the aneurisms of the head and joints, excepting only those of the groin, arm-pit, and neck, instead of confining it to the tumors of the arm alone, as had been done by Aëtius. All aneurisms, excepting aneurism by anastomosis, which he clearly and accurately distinguished, he conceived to originate in rupture of the coats of the artery. He performed extirpation of the mamma, by crucial incision; and practised both laryngotomy and tracheotomy. He is the first who seems to have performed the latter operation, as a means of carrying on respiration during occlusion of the larynx; but naturally enough, falls into the error of transverse instead of longitudinal incision. He describes different species of hernia, and did not hesitate to operate when the tumor became strangulated. He is also the first who treats of fracture of the patella. He was pre-eminent as an accoucheur, and was the originator of the obstetric operation of embryotomy.

From the time of Paulus, we find no Greek or Roman surgeon of note, until the appearance of Actuarius; a Greek, who practised with great distinction at Constantinople, probably about the beginning of the twelfth century; but at what exact period it is impossible to ascertain. Among his writings are found several surgical treatises, which, however, possess no greater merit that as compilations from previous authors.[1]

Having thus traced surgery from its origin, through the Egyptian, Greek, and Roman dynasties, we come to notice the prolongation of its feeble existence in Arabia.[2] From Alexandria, captured by the Saracens under Amrou in 640, knowledge was gradually communicated to Arabia. Its people became acquainted with medicine through the medium of translations of the Greek authors; and the "seat of learning was transferred, for a time, from beneath the shadow of the Cross to the empire of the Crescent; from the classic shores of Italy and Greece, to the warlike followers of Mahomet, and the fiery descendants of Ishmael." Many valuable manuscripts rescued from the savage destruction of the Alexandrian library, were carefully transcribed or translated into the

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[1] Mr. Francis Adams, a very erudite surgeon, practising in the vicinity of Aberdeen, has published the first volume of "The Medical Works of Paulus Ægineta, the Greek Physician, translated into English: with a copious commentary, containing a comprehensive view of the knowledge possessed by the Greeks, Romans, and Arabians, on all subjects connected with medicine and surgery." Lond. 1834, 8vo. And the whole works of Paulus have been published, under the editorship of Mr. Adams, in three volumes; by the Sydenham Society; 1844–47.

[2] Le Clerc, Histoire de la Medecine. Geneve, 1696, 8vo. Amst. 1723, 4to. Freind's History of Physick, from the time of Galen to the beginning of the sixteenth century. Lond. 1725–6, 2 vols. 8vo. Le Clerc only continues the history till the age of Galen. The literary history of the Greek physicians may be sought in the *Bibliotheca Græca* of Fabricius.

Syriac or Arabic languages, and dispersed in various directions. The first Arabic translation was made about the year 683, by Maserjawaihus, a native of Syria; but the most eminent in this labor was Honain, called, by way of eminence, "the translator," a Christian, born at Hira in 764. Towards the end of the eighth century, a college was founded at Bagdat by the caliph Almansor; and there medicine obtained a permanent footing, under the fostering care of the far-famed caliph Haroun al Raschid. Public hospitals and laboratories were founded by him for the benefit of students; who are said to have amounted at one time to no fewer than six thousand, consisting chiefly of Christians banished on account of their religion. And the caliph Almamon surpassed even his predecessors in munificent patronage, extended to every department of art and science; and in unwearied exertions to restore and propagate the various branches of learning. By supplication he prevailed upon the Grecian emperors to send him many works in philosophy; and, employing the best interpreters to be found, he ordered all these books to be translated, and encouraged the industrious study of them by his own personal example. The medical school at Jondisabour, the capital of Chorassan, established by Sapores the First as early as the end of the third century, had by this time risen to great celebrity; and from it Rhazes, Hally Abbas, and Avicenna derived their medical education Mesue lived during the caliphate of Haroun al Raschid, in the end of the eighth century, and Seraphion during that of Almamon, about a century later; both eminent medical men in their time, but both pure physicians.

The first Arabian worthy in the surgical department was the celebrated Rhazes, who presided over an hospital at Bagdat in the end of the ninth and beginning of the tenth centuries. His works are not remarkable for anatomical knowledge; which is not surprising, since the study of anatomy was strictly forbidden by the Mahommedan religion; and consequently the Arabians had to rest contented with the writings of the Greeks on that subject. "One of their religious prejudices against dissection was, that the soul did not instantly forsake the body, but lingered in some particular portion of it for some time after apparent dissolution, so that the dismemberment of it might be a species of hideous martyrdom;" a very sufficient reason why the professor of such a belief should strenuously object to the anatomization of himself and his friends. Rhazes is the first who has described spina ventosa and spina bifida. Of the real nature of the latter, however, he does not seem to have had any clear idea. Regarding cancer, he advised that the knife should never be used, except when the disease was limited, and the whole tumor could be completely removed; condemning the opposite procedure, as cruel and unavailing; an opinion which after experience has shown to be most just and true. In bites from rabid animals, he first cauterized the wounds, and then prescribed emetics to expel "the black bile," an evacuation considered most essential to the cure. His account of hernia is better than any to be found in the Greek writers. His works on surgery, however, are little more than compilations from Hippocrates, Oribasius, Aëtius, and Paulus. His confidence in oculism does not seem to have been great; for, having in his old age become blind from cataract, he could not, though urged, be prevailed upon to undergo an operation for its removal. In his time, lithotomy, and some other operations, seem to have been entirely in the hands of juggling impostors.

Hally Abbas, surnamed the Magician on account of the extent of his knowledge and acquirements, lived in the end of the tenth century. His great work, the Al-meleky, written about the year 980, is, in its anatomical and physiological department, a mere transcript from the Greeks; and his surgery possesses but few peculiarities. "From the idea that caustics were efficacious when the redundancy of the humors flowed to a particular part, he recommended their application for the cure of hydrocele. In the management of dropsical affections, his attention was always directed to the remote causes; and he preferred puncturing in the linea alba, a little below the umbilicus, for the relief of ascites."

Avicenna, who divides with Rhazes the honor of having first introduced chemistry into physic, flourished later than the two preceding Arabians. He was termed, in his day, the Prince of Physicians; and seems to have been regarded as almost miraculous, for the extent and variety of his knowledge. He was born in 980, and died in 1036; without a rival, either in the medical profession or in general science. In his great medical work, the Canon, the surgical department is not altogether forgotten, but holds a second place to physic; indeed, before the appearance of Albucasis, surgery seems to have been all but extinct amongst the Arabians. He has distinguished between closure of the pupil and cataract; and in operating for the latter recommends depression; extraction he considers a very dangerous experiment. It is probable that to him we owe the first use of the flexible catheter, as also of the instrument commonly known as Hey's saw. His works are said to have remained the oracles of medical knowledge for nearly six hundred years.

Albucasis, who died in 1122, exerted himself more than his predecessors in behalf of surgery; which, by his own account, he found in a most deplorable condition; and he is chiefly distinguished as a surgical writer. Cauteries and caustics seem to have been his favorite remedies; and he becomes enraptured when speaking of the "divine and secret virtues" of fire surgically employed. The actual cautery he looked upon with veneration, and describes more than fifty affections in which his experience had found it beneficial. He is minute in his directions for its application, and forbids its use, "except by persons acquainted with the anatomy of the frame, and the position of the *nerves*, *tendons*, *veins*, *and arteries;*" from which latter circumstance, some idea may be formed of the extent to which he himself was in the habit of roasting his unfortunate patients. He checked arterial hemorrhage by his favorite method of cauterization; but also employed styptics, as well as complete division of the vessel, and ligature. He is supposed to have been the first to remark, that it is by the formation of a coagulum in the orifice of an artery that its calibre is closed and hemorrhage arrested. He has described a particular instrument of his own for the cure of fistula lachrymalis, and the needle used by the surgeons of Irak for cataract. He speaks of operating for the relief of hydrocephalus, but the success of the practice does not seem to have been greater then than in its revival in our time; for he confesses that he knew of but one successful case, and therefore does not recommend the operation. He seems to have been conversant with the mode of removing tumors by ligature, when the knife is inexpedient; he advises amputation in gangrene of the extremities; and is the first who has described the mode of extracting calculus by incision, in the female. His method of lithotomy resembled that practised by Paulus Ægineta; and, like him, he seems to have been bold in puncturing and excising the tonsils, in removing the uvula when obstinately relaxed, and in extracting polypous tumors from the fauces. He mentions bronchocele as occurring most frequently among women; but, fond of the knife and cautery as he was, he does not seem to have employed either for the removal of that tumor. Indeed, he tells us of "an ignorant operator who," in attempting extirpation of a bronchocele, "by wounding the arteries of the neck, killed the patient upon the spot." He invented the probang, for dislodging foreign bodies from the gullet; and in wounds of the intestines practised union of the divided parts by suture, more than once with success. Though thus bold in his operations, and like all the Arabians, too fond of the employment of instruments, he was not however without judgment and caution. For example, he condemns tracheotomy as worse than useless, when the inflammatory affection of the windpipe is acute, and has extended to the bronchi; an opinion which is acknowledged as true, though unfortunately not always followed in the present day. And he exceeds even Rhazes in his dislike to operative interference with cancerous tumors, declaring that he never either cured, or saw cured, a single instance of that disease; a conclusion too nearly consistent with the history of that most implacable malady, in all succeeding ages. His remarks on abscesses are most judicious; directing particular attention to their situation, and recommending their being early opened, whether "matured" or not, when in the neighborhood of joints or other important parts, which would be injured by their continuance; a rule of practice which, if more faithfully followed, would materially diminish the number of diseased joints and bones. He also advised what has since been so much insisted on by Mr. Abernethy, that when the abscess is very large, its contents should be evacuated by degrees. He is the only one, among the ancient writers on surgery, who has described the instruments used in each particular operation.

Avenzoar, a Spanish Arab, practised physic with distinction, about the beginning of the twelfth century, at Seville in Andalusia. He describes inflammation and abscess of the mediastinum, from which he had himself suffered; and mentions a case of abscess of the kidney, from which fourteen pints of matter were evacuated. He speaks of bronchotomy as expedient in dangerous cases of inflammation of the tonsils; and, in stricture of the gullet, proposes three modes of treatment; the occasional passage of a tin or silver tube; the use of a milk bath, that nutritious particles may be taken up by the pores of the skin; and the injection of nutritious fluids by the rectum. He also details cases of "rupture, fracture of the hip-bone, wounds of the arteries and veins, tumors, and other varieties of surgical disease, which he appears to have understood well, and treated with discretion." He does not complain, like Rhazes, that lithotomy was in the hands of mountebanks; but tells us that the Arabians then reckoned such operations "filthy and abominable, and unfit for any man of character to perform;" and held that "no religious man, according to the law, ought so much as to view the genitals."

The brightest name in the history of Arabian philosophy is that of Averrhoes, the pupil of Avenzoar; born at Cordova about the middle of the twelfth century, and said to have died in the year 1206. But he cultivated the study of medicine only as a branch of general philosophy; and surgery he seems to have altogether neglected.

Such were the Arabians. Of these, Albucasis was the most famous in surgery; as Celsus had been among the Romans, and Paulus Ægineta among the Greeks. But even he could not escape the unfortunate failing of the Saracenic school; endless invention of manifold and complicated instruments; attaching far too much importance to the mechanical part of their profession; and mistaking the inspiration of terror, and infliction of cruelty, for energetic and judicious surgery. In order, for example, to arrest hemorrhage from a wounded surface, if time pressed and assistants were scarce, it was not uncommon to dip the part into boiling pitch; a liquid which was then dignified with the appellation of a styptic. They, however, systematically divided physic, surgery, and pharmacy, into three distinct professions; and so, by commencing the division of labor, may be considered as having done something, not unimportant, towards the ultimate advancement of medical knowledge. "The last traces of their intellectual illumination appeared among the Spanish Moors in the thirteenth century, when the Christian arms having become more and more powerful, they were compelled to substitute the field for the study—the sword for the pen—and, before an overwhelming opposition, were at length driven from a region whose fields they had tilled, and whose olives they had gathered, for a thousand years. With the decline of the Saracenic school, the daylight of Science went down over the nations; and an intellectual darkness, which endured for three hundred years, enveloped the general face of society. All the fountains of science were dried up, and the world seemed retrograding into the unillumined chaos of ignorance."[1]

A knowledge of the Greek and Arabian systems of medicine was introduced into Italy, at Salerno, in the beginning of the eleventh century; and this school soon rose to celebrity as a seat of medical learning. In the time of the Crusades, Salerno was a place of great resort for warriors of all nations passing between Europe and Palestine; and by these wanderers, on their return, the light of medical science was thence slowly conveyed over Europe. It obtained the privileges of a university; but the medical school of Salerno did not long retain its high reputation. In modern times, it is chiefly remembered on account of the *Regimen Sanitatis Salernitanum;* a singular production, of which more than one hundred and sixty editions are known to have been published. Though written in the name of the *Schola Salernitana*, it has generally been ascribed to Joannes de Milano. The English king to whom it is addressed is supposed to have been Robert of does not recommend the operation. He seems to have been conversant with the mode of removing tumors by ligature, when the knife is inexpedient; he advises amputation in gangrene of the extremities; and is the first who has described the mode of extracting calculus by incision, in the female. His method of lithotomy resembled that practised by Paulus Ægineta; and, like him, he seems to have been bold in puncturing and excising the tonsils, in removing the uvula when obstinately relaxed, and in extracting polypous tumors from the fauces. He mentions bronchocele as occurring most frequently among women; but, fond of the knife and cautery as he was, he does not seem to have employed either for the removal of that tumor. Indeed, he tells us of "an ignorant operator who," in attempting extirpation of a bronchocele, "by wounding the arteries of the neck, killed the patient upon the spot." He invented the probang, for dislodging foreign bodies from the gullet; and in wounds of the intestines practised union of the divided parts by suture, more than once with success. Though thus bold in his operations, and like all the Arabians, too fond of the employment of instruments, he was not however without judgment and caution. For example, he condemns tracheotomy as worse than useless, when the inflammatory affection of the windpipe is acute, and has extended to the bronchi; an opinion which is acknowledged as true, though unfortunately not always followed in the present day. And he exceeds even Rhazes in his dislike to operative interference with cancerous tumors, declaring that he never either cured, or saw cured, a single instance of that disease; a conclusion too nearly consistent with the history of that most implacable malady, in all succeeding ages. His remarks on abscesses are most judicious; directing particular attention to their situation, and recommending their being early opened, whether "matured" or not, when in the neighborhood of joints or other important parts, which would be injured by their continuance; a rule of practice which, if more faithfully followed, would materially diminish the number of diseased joints and bones. He also advised what has since been so much insisted on by Mr. Abernethy, that when the abscess is very large, its contents should be evacuated by degrees. He is the only one, among the ancient writers on surgery, who has described the instruments used in each particular operation.

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[1] Moir's Outlines of the Ancient History of Medicine. Edinb. 1831, 16mo. Of this excellent work we have not scrupled to make free use in the course of the preceding observations.

Avenzoar, a Spanish Arab, practised physic with distinction, about the beginning of the twelfth century, at Seville in Andalusia. He describes inflammation and abscess of the mediastinum, from which he had himself suffered; and mentions a case of abscess of the kidney, from which fourteen pints of matter were evacuated. He speaks of bronchotomy as expedient in dangerous cases of inflammation of the tonsils; and, in stricture of the gullet, proposes three modes of treatment; the occasional passage of a tin or silver tube; the use of a milk bath, that nutritious particles may be taken up by the pores of the skin; and the injection of nutritious fluids by the rectum. He also details cases of "rupture, fracture of the hip-bone, wounds of the arteries and veins, tumors, and other varieties of surgical disease, which he appears to have understood well, and treated with discretion." He does not complain, like Rhazes, that lithotomy was in the hands of mountebanks; but tells us that the Arabians then reckoned such operations "filthy and abominown at Avignon, and is "accounted one of the revivors of the languishing art." The amputating knife was held in but slight esteem by him, as will afterwards be shown. In his *Chirurgia*, a history of the state of surgery in his day,[1] we find the first mention of the Cæsarean operation. Contemporary with him was John of Ardern, an English surgeon. He wrote with simplicity and honesty, and may be regarded as a revivor of surgery in that country. In his practice he was peculiarly successful in the treatment of fistula in ano, and thereby acquired a great reputation. He also improved both the use and the construction of the trepan; adding the central pin, and limiting the operation to the severe forms of injury of the head. Valesco de Taranta, a Portuguese, practised at Montpellier, and wrote on surgery in the beginning of the fifteenth century. He was the first who proposed the cure of cancer by the application of arsenic. About the middle of the same century, lithotomy, the practice of which had hitherto been confined to itinerant and ill-informed operators, was restored to the regular profession by Germain Colot, a French surgeon, high in favor with Louis the Eleventh. He first contrived to witness the operation by the itinerants, then practised it on the dead body, and at last performed it successfully on a condemned criminal who happened to be afflicted with stone, and who consented to undergo the operation on condition of being pardoned, if he survived. His success, in having thus doubly saved life, obtained for Colot much renown; and lithotomy ever after continued a regular part of surgical practice.[2]

The fifteenth century contains other two events important to surgery; the discovery of the art of printing, about the year 1450, which gave a new impulse to science and literature, by rendering the accumulated stores of knowledge more accessible; and the alleged importation of the venereal disease from America, by the first discoverers of that continent, giving the *small* pox as if in exchange, about the year 1493.[3] In this century also the Turks captured Constantinople, thus overthrowing the last remains of the Eastern empire; and by the multitude of Christians who fled from that city, many manuscripts of the Greek medical writers were brought to Italy, and their contents thence slowly disseminated over Europe.

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[1] Some idea may be formed of the languishing state of surgery at this time, from his division of the surgeons into the following five sects: The first applied cataplasmus indiscriminately to every description of ulcer and wound. The second in similar cases employed wine only. The third used emollient ointments and plasters. The fourth chiefly, military surgeons, promiscuously employed oils, wool, potions, and charms. The fifth, "consisting of ignorant practitioners and silly women, had recourse upon all occasions to the saints, praised each other's writings perpetually, and followed each other in one undeviating track like cranes."

[2] In the beginning of the sixteenth century, cutting upon the staff was introduced by Johannes de Romanis and Marianus Sanctus, and very successfully followed by Laurence Colot, a descendant of Germain.

[3] The first author who clearly describes the venereal disease is Marcellus Cumanus, who wrote in 1495. It was not till 1530 that Fracastorius wrote his celebrated poem *De Morbo Gallico*, in reference to which it has been said that the chaste and classic elegance of its language was worthy of the best days of imperial Rome, and the mellifluence of its versification hardly surpassed by the bard of Mantua himself. By G. Torella, physician to Pope Alexander the Sixth, we are informed that the insane abuse of mercury as a means of cure was not quite a universal practice on the outbreak of the disease; for, in describing some particular forms of mercurial ointment, he himself states that "they destroyed an infinite number of people, who in this case did not die, but were downright killed; and these bold empirics must give an account, if not in this, in the next world, of their practice, and be drowned in the pit of repentance." It is but very lately that the "pit of repentance" ceased to be useful under very similar circumstances. That the venereal disease existed, however, in Europe, centuries before the return of Columbus from Spain, seems sufficiently established by reference to the earlier authors; Albucasis and Avicenna mention ulcers and warts upon the penis; Gulielmus de Saliceto, 1280, treats cf buboes caused by disease of the penis

Hitherto, surgery can scarcely lay claim to an actual revival. Occasional attempts had been made to raise it from its low position, but all proved abortive. At length, however, in the beginning of the sixteenth century, the practitioners of the healing art were happily convinced that the observation of nature was superior to compilation from the ancients, whether Arabian, Roman, or Greek; they consequently ceased to tread blindly and servilely in the footsteps of their predecessors, and a new era arose to the profession. About the same time Vesalius gave birth to anatomy, properly so called;[1] illuminated by which science, surgery became a worthy object of pursuit to men of talents and education; and, under their cultivation, it was gradually raised to an enlightened and liberal profession.

The most conspicuous name, in this new era of surgery, is that of Ambrose Paré, a Frenchman. In this country, surgery was then sadly depressed; having retrograded since the time of John of Ardern. Its list of practitioners comprised barbers, farriers, sow-gelders, cobblers, and tinkers; and it is not matter of surprise that from among these no name has been handed down as worthy of remembrance. The combination of the practice of surgery with the more harmless manipulations of the barber, was not confined, however, to this island; but existed also in France, and continued in both countries for upwards of two hundred years. The great Paré does not reject the appellation of barber-surgeon, as applied to himself; nor does he seem to think that there is anything derogatory in the title. He was surgeon successively to Henry the Second, Francis the Second, Charles the Ninth, and Henry the Third, of France; and followed the French armies in all their campaigns, down to the battle of Moncontour, in 1569. His consequent experience of gunshot and other wounds, on the field of battle, naturally directed his attention to the subject of hemorrhage. And it is to him that we owe the revival and improvement of the method of arresting bleeding from arteries by ligature, and discontinuance of the cauteries and styptics; which, to the disgrace of surgery, had hitherto been in exclusive use for this purpose. Yet so averse are mankind to abandon their ancient customs, that the improvement of Paré was not sanctioned till after much abuse and persecution, directed both against himself and his discovery; indeed, so bitter and unrelenting were his jealous brethren, that he was compelled for his own safety, to adduce garbled and incorrect extracts from Galen and other ancients, in proof that to them, and not to him, the invention was to be referred. So far, he was less in error than he himself supposed; for we have already stated that he has merely the merit of reviving the use of the ligature.[1]

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from impure intercourse; and both Valesco and John of Gaddesden (1305–1320) mention pustules and ulcers of the penis from a similar cause.

[1] A little later in the century, Fallopius taught anatomy at Pisa, and Eustachius at Rome, and to their efforts, as well as to those of Vesalius, the advancement of that science is much indebted. Fallopius died in 1563; Eustachius in 1574.

Celsus distinctly advises its employment, when pressure fails to stop arterial hemorrhage; and Albucasis sometimes condescended to use it, instead of his favorite cautery and cruel styptics. But so little had surgeons in general profited in this respect, before the time of Paré, that amputations usually proved fatal; partly on account of the hemorrhage, partly in consequence of the severe measures employed for its arrest. We find Guy de Chauliac asserting that it was better "to let the limb drop off, than to cut it off;" and his own operations consisted in placing pitch plasters very tightly round the joint, and thus causing the limb to mortify.

Paré was amply repaid, by future fame, for the opposition which he had at first sustained. He rose to an unparalleled height of popularity with the army, by whom he was absolutely adored. On one occasion, his mere presence, among the garrison of a beleaguered city about to capitulate, reanimated the troops to such an extent, that their resistance became more energetic than before, and the besieging army perished beneath the walls. By his sovereigns he was also highly esteemed. From the general massacre, on the fearful night of St. Bartholomew, he was rescued by the personal exertions of Charles the Ninth; his great merits being appreciated even by that weak and cruel monarch. But he was not content with the respect and praise of his contemporaries; his writings, the result of great experience and accurate observation, freed from the yoke of authority, and digested by genius of a high order, have rendered him immortal. He was the first to use the twisted suture in harelip, and similar wounds; copying the mode of application from the manner in which the ladies and tailors of the day wound the thread round the needle, and thus carried both safely in their cuffs or caps. His works, first published in 1535, and afterwards more fully in 1582, exerted a most powerful and beneficial influence upon his profession. The influence was not, however, immediate; for, at his death, the light he had shed was for a time obscured; surgery reverting to the state of degradation in which he found it, in consequence of its baneful association with barberism. Pigrai was his successor, but an unworthy one: endeavoring to follow the footsteps of his master, he obscured and almost effaced them. The most interesting of Paré's surgical treatises is that on gunshot wounds; a class of injuries then of recent introduction, and little understood. The murderous cannon and firelock had not been long in use.

In the seventeenth century, surgery again revived; resuming the impulse which the genius of Paré had imparted. Italy produced Cæsar Magatus, who simplified, and consequently must have improved, the treatment of wounds; the never-to-be-forgotten Tagliacotius, with his rude repairs of the human face; and Marcus Aurelius Severinus, a skilful and intrepid operator. At the end of the sixteenth, and beginning of the seventeenth centuries, Padua was favored with Fabricius ad Aquapendente; the preceptor of Harvey, a most distinguished physiologist, and the most eminent surgeon of his time. His *Opera Chirurgica*

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[1] As an example of how little the hint of Celsus was attended to, we may mention, that Procopius relates how Artabazes perished of a wound in the neck "the artery of the neck having been cut through, so that the blood *could not be stopped*." Their cauteries and styptics had no effect on the carotid, or its larger trunks.

passed through no less than seventeen editions, and contain not only an excellent digest of surgery as it then was, but also many improvements of his own. To him we are indebted for the modern Trephine, and for the use of the tube after tracheotomy.

About the middle of the seventeenth century, arose the true father of British surgery; our own Wiseman, the Paré of England. One or two English names are to be found before him: William Clowes, a military surgeon of some eminence, attended the Earl of Leicester's army in the Low Countries, and wrote on gunshot wounds; and Lowe, a Scotchman, gave to the world a discourse on the whole art of Chirurgery, dated 1612; but Wiseman, doubtless, is the first Briton worthy of note in surgery. He was serjeant-surgeon to Charles II, and amidst the horrors of the civil wars, had ample scope for the study of his profession. His surgical works, consisting of eight treatises, dated 1676, contain much information; at that time most valuable, and still amply rewarding an attentive persual. In military practice, he strongly advocated immediate amputation, "while the patient is free of fever," in the case of such injuries as rendered preservation of the member improbable; of course allowing the primary shock of the accident to be past; a point of practice which long discussion in after years served but to confirm. It was not till his time, that surgeons ceased to believe that gunshot wounds were necessarily envenomed by the powder and ball, and had to be treated accordingly with potent and cruel dressings.

The immortal Harvey, contemporary with Wiseman, cannot, perhaps, be classed among the eminent surgeons; having principally confined himself to anatomy and physiology. Yet he is inseparably connected with that science, by his discovery of the circulation of the blood; a discovery which has done so much for the advancement of all medical knowledge, but of surgery in particular. James Young, a surgeon in Plymouth, may be said to have been also contemporary with Wiseman; having written in 1679. He is the first who proposed amputation by a flap; an improvement to which two French surgeons, Verduin and Sabaurin, lay claim; and he is also the first who recommends limited compression of the main artery in amputation.

Germany boasts of several eminent surgeons of this time; Fabricius Hildanus, a most successful practitioner, and author of a surgical treatise, dated 1641; Scultetus, author of the work, celebrated for its horrid array of lethal weapons, called *Armamentarium Chirurgicum*, 1653; and Purmann, who displayed too great an attachment to the dangerous representations of Scultetus. Heister, a professor in the University of Helmstadt, wrote a system of surgery; which has been translated into most of the European languages, and is still in high repute.

Holland likewise possessed successful practitioners of surgery; but tainted with an unworthy concealment of their methods of cure. Rau, a native of Germany, though a professor at Leyden, was perhaps the most successful lithotomist that ever lived. He kept his method of operating, which he had been taught by Frère Jacques, a profound secret, and made it a mystery even to his own pupils; as appears from the circumstance, that his two favorites, Heister and Albinus, of a more liberal spirit than their master, in attempting to divulge his secret for the benefit of the profession at large, have varied most materially in their statements. This illiberal spirit pervaded the other branches of medicine as well as the surgical. The famous anatomist Ruysch preserved inviolate the secret of his wonderfully minute injections, although really the discovery of his friend De Graaf; and Roonhuysen, the accoucheur, worked stealthily with his invented lever. The latter was probably the first who had recourse to tenotomy, for the removal of deformity; having divided the sterno-mastoid for wry-neck. The succeeding generation, however, removed the stigma of secrecy from the Dutch; and their great Campor was equally celebrated for the number of his discoveries, and for the zeal with which he made them known.

From the time of Paré, France produced no surgeons of great eminence, until the eighteenth century. In the seventeenth, we find the names of Dionis, Belloste, Saviard, Morel, and a few others of some renown, but not at all equal to their contemporaries in other nations. Some idea may be formed of the then feeble condition of surgery in France, from the fact that Louis XIV was not cured of a simple fistula in ano, until after his life had been in no small degree endangered by repeated abortive operations. That the French can boast of surgeons of the first class in the next century, however, is indisputably shown by the simple mention of Petit and Desault—names that must ever occupy a proud place in the annals of surgery. The former, adding to the most powerful talents great industry, and an innate love of his pursuits, rose rapidly to eminence; though not without much envious opposition, which seems to be the portion of nearly all those who occupy a pre-eminent place in the profession. On general surgery, he has left a work of much value; and his treatise on diseases of the bones, though produced at an early age, entitles him to be called the father of that branch of pathology. For many years it remained the best work on the subject. He was the inventor of the screw-tourniquet, and the first who operated for fistula lachrymalis by transfixion of the sac. His extra-peritoneal operation, in hernia, has been revived; and is now extensively adopted by the profession. He contributed largely to the memoirs of the Royal Academy of Surgery—an institution which has done much for the advancement of surgery, not only in France but throughout the world. Its memoirs, containing the result of the labors of many eminent men, constitute a work of the greatest value.

Desault, also of high reputation, both as an anatomist and as a surgeon, was the first who taught surgical anatomy, and gave clinical lectures on surgery. His improvements on the apparatus for fractures were most important; and a splint invented by him is still in use, modified, for fractures high in the femur. His adaptations of cutting instruments were also good; among others, changing the amputating instrument to a straight knife, instead of the old curved weapon. He was the first who contemplated the cure of artificial anus, resulting from strangulated hernia; and he further improved Paré's revival of ligature of the arteries. The proposal of curing aneurism by ligature of the vessel on the distal side of the tumor originated with him—a proceeding, however, of which the merit is still dubious. His writings are both valuable and extensive.

After the great names of Petit and Desault, not a few French surgeons of the same century, though less eminent, yet deserve mention: Le Dran, a copious and excellent author; Sabatier, famous in the department of operative surgery; Garengeot, Louis, La Motte, Frère St. Cosme,[1] Portal, Pouteau, Lecat, Chopart, Morand, Moreau, &c.

It is about the middle of the eighteenth century, that attention is first attracted to our Transatlantic brethren. In 1763, lectures on anatomy and surgery were delivered in Philadelphia by Dr. Shippen; and in 1791 the medical school of that city was completely established, under Benjamin Rush, the Hippocrates of Columbia—a school which has since lent valuable aid to the progress of both medicine and surgery.

Our own country was at this time by no means barren in surgery. Percival Pott and John Hunter are names which occur, the one in the middle, and the other in the end of the eighteenth century, and are fully equivalent to Petit and Desault; indeed Hunter may be justly ranked as the greatest man that ever graced the profession. Pott, the best author, operator, and practical surgeon of his time, greatly improved the practice of surgery in England, both by his writings and by personal example. Like Desault, his attention was particularly directed to the treatment of fractures; of which he had some painful experience in his own person, having sustained a severe compound fracture of the leg. He has left a justly celebrated treatise on the subject. On amputation, his observations are most important; clearly discriminating between those cases, of injury more particularly, which demand the operation, and those which do not; at the same time, marking the period most advantageous to its performance. Regarding injuries of the head, he wrote with more precision, and at the same time with more originality, than any previous author; and will ever remain a valued authority upon that subject. The same may be said of his description of vertebral disease—he having been the first who clearly distinguished between those curvatures of the spine depending on mere change of form in the bones, and those occasioned by caries or abscess. The latter formidable affection is still known as "Pott's Disease" of the vertebræ. He greatly improved the treatment of fistula in ano, and abscesses in general; and by simplifying the whole art of surgery—discarding the cautery and escharotic unguents, or rather limiting them to their proper place and use, employing also the cutting instruments with caution and reserve, and placing more implicit trust in, and showing more respect for, the powers of Nature, than had hitherto been the custom—he achieved a most important and beneficial reform. Until his time, the maxim "Dolor medicina doloris" remained unrefuted. The actual cautery, for example, was in such general use, that "at the time when surgeons visited the hospital, it was regularly heated and prepared in the wards, and in the presence of the patients, as a part of the necessary apparatus. Mr. Pott lived to see these remains of barbarism set aside, and a more humane and rational plan, of which he was the originator, universally adopted."

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[1] Frere Jean de St. Cosme, although a monk, was the inventor of the Lithotome Cache, and with it obtained wonderful success and celebrity as a lithotomist. He considered himself specially commissioned by Heaven to cut for stone, fistula, and rupture; and led a life of the greatest practical piety and self-denial, seeking only enough of money to obtain the ordinary necessaries of life, and to keep his instruments efficient. Though at first but an uneducated friar, he certainly had the merit of having converted the tearing into a cutting operation, with success. In 1700 he studied anatomy at Versailles under Du Verney, and then improved his operative procedure by laying the foundation of the lateral operation, as now practised with the knife. He received a medal from the Senate of Amsterdam, bearing the motto, "ob cives servatos," and was presented with golden sounds at the Hague. He taught his operation to Rau and Marechal; the former of whom practised it with remarkable success, but with an unworthy secrecy.

John Hunter, a native of Scotland, the pupil, first of Cheselden, and afterwards of Pott, though not remarkably distinguished as an operator, was the most gifted surgeon of which the medical profession can boast; and no less eminent as an anatomist, physiologist, and general philosopher. His researches comprehended a wider range than those of Pott, but arrived at the same end—the improvement of surgery. The knowledge obtained by his vast inquiries into physiology, pathology, and human and comparative anatomy, was, with all the power of his genius, brought to bear upon the practice of the profession, and with the happiest success. The doctrines of adhesion, granulation, and inflammation with its various results, were, until explained by him, comparatively obscure and uncertain; and no one is ignorant how much the successful treatment of disease, either by surgery or medicine, must ever depend on an accurate and familiar knowledge of these rudiments. To him we are indebted for the simplification of more than one operation, the discovery of the vitality of the blood, important advice as to the treatment of gunshot wounds, the enforcement of excision of bitten or poisoned parts, many new facts as to the physiology and pathology of teeth, and other valuable additions to practical surgery. But these assume an unimportant place among his deeds, when placed beside the two with which his name is indelibly associated—the cure of popliteal aneurism by ligature of the femoral artery, and the elucidation of the venereal disease; his work on the latter subject still remaining standard, and in many respects unsurpassed. His improvement of the operation for aneurism marks an era in the history of surgery, being one of the most important of its advances. Dissatisfied with the cruel, formidable, and unsatisfactory operation for popliteal aneurism, by incision of the tumor and ligature of the vessel at its diseased part, as first practised by Rufus and Antyllus, he made himself aware of the causes of failure by the old system, contemplated the plan of cure which bears his name, satisfied himself of its practicability by diligent study and experiment, successfully brought it to the test of actual practice; and then, extending the principle to all aneurisms, effected for surgery a great triumph over that formidable disease.[1] His first operation was performed in 1785. Since his time, the method of applying ligature has been considerably improved, and the certainty of success consequently increased. But "the more brilliant a discovery, and the more beneficial its results, the more certain is its author of becoming the butt of envy and the object of detraction." And, accordingly, we find that Hunter has not been permitted to remain in undisturbed possession of his discovery. Its merit has by some been claimed as due to Aëtius; others, with better hope of success, support the pretensions of Guillemeau (a pupil of Ambrose Paré), Anel,[2] and

[1] "So discouraging were the results of the old operation, that many surgeons preferred performing amputation of the aneurismal limb."

[2] Guillemeau and Anel placed their incisions and ligatures in the immediate neighborhood of the tumor.

Desault; but a candid inquiry into facts and dates, will ever result in ascribing the honor to our illustrious countryman. Had he even been deprived of this, his name must still have been immortalized by other and more palpable labor of his mind and hand—his writings and museum.

In the same century with Pott and Hunter, Britain also produced White, an excellent practical surgeon and lucid writer, the originator of Excision of Joints; Cheselden and Douglas, two eminent lithotomists, the former peculiarly successful; Sharp, famed for his Critical Inquiry into the State of Surgery; and Monro, a name indissolubly united with the birth and fame of the Edinburgh medical school.[1]

In Italy, where, during the times of Pott and Hunter, several eminent surgeons lived—Lancisi, Morgagni, Bertrandi, Troja, &c.—the labors of Hunter in aneurism were ably followed up by Scarpa; who still further elucidated the doctrines regarding the new treatment of that disease, and established the success of the operation. He was also eminently successful in his researches as to the anatomy and pathology of hernia; a subject which he has made peculiarly his own.

The same century saw in Germany, Schmucker, Richter, and the great Haller; whose *Disputationes Chirugicæ* bear, equally with his other works, the impress of both labor and genius of a high order.

The nineteenth century will not yield to any former era in a numerous and bright array of names dear to surgery. It has seen the fall of Abernethy, Dupuytren, Cooper, Liston—brilliant stars in the galaxy; and mourns others highly valued. But vast and powerful is the host who are still laboring, with distinguished success, in their noble calling. In all civilized countries, the dark days of the healing art have, we trust, for ever passed away; and many are the illustrious names with which surgery is now adorned, more particularly in France, Germany, America—and last, not least, Great Britain.

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[1] Dr. Monro was appointed professor of anatomy to the Company of Surgeons in 1719, and during the ensuing year he was appointed to a similar chair in the University. Several other professors in the same faculty had previously been nominated; Sir Robert Sibbald, Dr. Halket, and Dr. Pitcairne, so early as the year 1685. But Dr. Monro was the first who regularly delivered public courses of lectures, and he may in a great measure be regarded as the founder of the medical school of Edinburgh.

INDEX.

Abscess, acute, 181
Abscess, chronic, 192
Abscess, chronic, subcutaneous opening of, 195
Abscess, consecutive, 203
Abscess, constitutional treatment of, 200
Abscess, counter-opening of, 197
Abscess, diffuse, 201
Abscess, mode of opening, 188
Abscesses, multiple, 204
Abscess of bone, 372
Abscess of bone, scrofulous, 378
Abscess of bone, tubercular, 378
Abscess, secondary, 203
Abscess, treatment after incision of, 190
Absorption, 259
Absorption of bone, 380
Absorption of bone, interstitial, implicating joint, 460
Aconite, as an antiphlogistic, 153
Activity, disorder of functional, 108
Adhesion, healing by, 175
Adhesion of wounds, treatment for, 555, 565
Amputation in aneurism, 514
Amputation in gangrene, 253
Anæmia, 327
Anæsthesia, 72, 658
Anchylosis, 470
Anchylosis, fibrous, 471
Anchylosis, ligamentous, 471
Anchylosis, osseous or complete, 470
Anchylosis, spurious, 471
Aneurism, 483
Aneurism, amputation in, 514
Aneurism, Brasdor's operation for, 505
Aneurism by anastomosis, 522
Aneurism, causes of, 494
Aneurism, collateral circulation in, 502
Aneurism, cure of, 495
Aneurism, diagnosis of, 492
Aneurism, diffuse, 485
Aneurism, dissecting, 484
Aneurism, false, 486
Aneurism, false, treatment of, 519
Aneurism, fatal result of, 492
Aneurism, Hunterian operation for, 497
Aneurism, ligature in, 498
Aneurism, ligature in, casualties of the operation, 515
Aneurism, pedunculated, 485
Aneurism, spontaneous cure of, 496
Aneurism, surgical treatment of, 497
Aneurism, symptoms of true circumscribed, 488
Aneurism, treatment after operation for, 503
Aneurism, treatment by injection, 513
Aneurism, treatment by pressure, 507
Aneurism, treatment by galvanism, 513
Aneurism, true, 483
Aneurism, Valsalva's treatment of, 518
Aneurism, varicose, 520
Aneurism, varieties of ligature in, 506
Aneurism, varieties of, 484
Aneurism, Wardrop's operation for, 506
Aneurismal diathesis, 495
Aneurismal varix, 521
Angeioleucitis, 542
Animation, suspended, 654
Anthrax, 352
Antimony, tartrate of, as an antiphlogistic, 151
Antiphlogistics, 136
Antiphlogistic, aconite as an, 153
Antiphlogistic, antimony as an, 151
Antiphlogistic, belladonna as an, 153
Antiphlogistic, colchicum as an, 153
Antiphlogistic, cold as an, 155
Antiphlogistic, croton oil as a local, 163
Antiphlogistics, diuretics as, 153
Antiphlogistics, emetics as, 148
Antiphlogistic, fomentation as an, 156
Antiphlogistics, heat and moisture as, 156
Antiphlogistic, iodine as a local, 158
Antiphlogistic, mercury as an, 148
Antiphlogistic, nitrate of silver as a local, 157
Antiphlogistic, opium as an, 150
Antiphlogistics, purgatives as, 147
Antiphlogistic regimen, 154
Antiphlogistic, rest as an, 154
Antiphlogistics, saline medicine as, 154
Antiphlogistics, suppurants as, 162
Antiphlogistic, tartar-emetic as a local, 162
Antiseptics, 249
Appendix, 663
Areolar tissue, diffuse inflammation of, 354
Arterial degeneration, 482
Arterial hemorrhage, 306
Arterial hemorrhage, secondary, 322
Arterial varix, 528
Arteries, diseases of the, 479
Arteries, torsion of, 320
Arteriotomy, 142
Arteritis, acute, 479
Arteritis, chronic, 481
Artery, spring, forceps, 317
Articular caries, 467
Articular ulcer, 466
Atheromatous degeneration of arteries, 481
Atrophy, 258
Atrophy of bone, 369
Atrophy of cartilage, 459

Ball-forceps, 592
Belladonna as an antiphlogistic, 153
Bistoury, use of, in abscess, 188
Blisters, 162
Blood, appearances of the, in inflammation, 110
Blood, diagram of, 95
Blood, effects of loss of, 325
Bloodletting, general, in inflammation, 136; tolerance of, 137; effects of, 138; mode of, 140; reaction, 140
Bloodletting in inflammation, circumstances which affect, 139
Bloodletting, local, varieties of, 147
Boil, 351

Bone, abscess of, 372
Bone, absorption of, 380
Bone, affections of, 363
Bone, atrophy of, 369
Bones, bending of, 612
Bone, caries of, 382
Bone, change of structure in, 371
Bone, death of, 389
Bone, entozoa in, 428
Bone, fragility of, 408
Bone, hypertrophy of, 369
Bone, inflammation of, 370
Bone in joints, destruction of, 466
Bone, interstitial absorption of, implicating joint, 427
Bone, neuralgia of, 370
Bone, pulsating tumors of, 427
Bone, reproduction of, 398 ; theory of, 406
Bone, scrofulous abscess of, 378
Bone, suppuration of, 372
Bone, tubercular abscess of, 378
Bone, ulceration of, 381
Bone, vascular tumors of, 427
Brasdor's operation for aneurism, 505
Bruise, 651
Bruit of aneurism, 488, 494
Bubo, 60
Bunion, 476
Burns, 602 ; treatment of, 605
Bursæ, affections of, 475
Bursæ, loose bodies in, 477
Bursitis, acute, 475
Bursitis, chronic, 476

Cachectic affections, 49
Cachectic sore, 217
Cachexy, cancerous, 58
Calcareous tumors, 277
Callus, definitive, 618
Callus, provisional, 618
Cancer, 58, 283 ; treatment of, 285
Cancer, colloid, 296
Cancer, malignant, 59
Cancerous cachexy, 59
Cancerous diathesis, 59
Carbonic acid, poisonous effects of, 656
Carbuncle, 352
Carcinoma, 281
Caries, 382 ; treatment of, 384
Caries, articular, 467
Caries of the skull, mercurio-syphilitic, 384
Caries of the vertebræ, 387
Carte's instrument for compressing femoral artery, 508
Cartilage, disease of, 444 ; treatment of, 451
Cartilage, articular, acute destruction of, 455
Cartilage. articular, scrofulous destruction of, 456
Cartilage, atrophy of, 459
Cartilage, hypertrophy of, 458
Cartilage, simple destruction of, 448
Cartilaginous tumors, 277
Cautery, actual, 164
Cautery, actual, as a hemostatic, 316
Cautery, Corrigan's small, 161
Cephaloma, 290
Chilblain, 609
Chloroform, inhalation of, 658
Cholesteatoma, 273
Chondroid tumor, 272
Cicatrix, 178
Cicatrization, 178
Classification of tumors, 269
Cloaca, 396
Colchicum as an antiphlogistic, 153
Cold as an antiphlogistic, 155
Cold as a hemostatic, 314
Cold, effects of, 609
Cold, effects of exposure to, 656
Colloid cancer, 296
Coma, 69
Comminuted fracture, 611
Compound dislocation, 644
Compound fracture, 611, 625
Compress, graduated, application of, 311
Compressor, Signoroni's, 312
Congestion, 94, 169
Congestion, active, 97, 169
Congestion, passive, 170 ; causes, 171, results, 171 ; treatment, 172
Constitutional affections, 33
Constitutional sore, 233
Convulsion, 74
Corrigan's small cautery, 161
Counter-irritation in inflammatory affections, 159
Counter-opening of abscess, 197
Cramp, 74
Crepitus, 614
Croton oil as a local antiphlogistic, 163
Cupping, 114
Cupping, dry, 161
Cysto-sarcoma, 275
Cystic tumors, 275

Degeneration of arteries, 482
Degeneration of tumors, 265
Deligation, phlebitis following, 518
Delirium, 69
Delirium tremens, 85
Delitescence, 116
Deposits, inflammatory, 117
Deposit, organization of, 117
Deposit, plastic, 119
Deposit, porcellanous, 459
Desmoid tumor, 272
Diastasis, 629
Diathesis, aneurismal, 495
Diathesis, cancerous, 59
Diathesis, hemorrhagic, 328
Discussion of tumors, 266
Disease, coincidence of internal with external, 90
Disease, external and internal, from a common cause, 92
Disease, external, causing internal, 91
Disease, internal, causing external, 91
Dislocation, 635 ; causes of, 635 ; symptoms of, 636 ; diagnosis of, 637 ; consequences of, 638 ; treatment of, 640
Dislocation, compound, 644
Dislocation, reduction of, 640
Dissection, poisoned wounds by, 571
Diuretics, as antiphlogistics, 153
Dressing of wounds, 554
Dropsy, acute, 118
Drowning, 655
Dry-cupping, 161

Ecchymosis, 653
Eclectics, 168
Emetics, as antiphlogistic, 148
Emprosthotonos, 594
Enchondroma, 420
Encysted tumors, 301
Entozoa in bone, 428
Entozoa in the integument, 355
Epilepsy, 89

Epithem, 157
Equinia, 585
Erysipelas, 334
Erysipelas, bilious, 345
Erysipelas, erratic, 346
Erysipelas, general characters of, 347
Erysipelas, hospital, 348
Erysipelas, œdematous, 345
Erysipelas, periodic, 346
Erysipelas, phlegmonous, 340; treatment of, 341
Erysipelas, simple, 335; cause of, 336; treatment of, 337
Erythema, 333; treatment of, 334
Escharotics in hemorrhage, 315
Excitement, simple vascular, 96
Exfoliation, 389
Exostosis, 417
Exudation, general characters of, 122

False aneurism, 486
False aneurism, treatment of, 519
False joints, 629
Farcy, 586
Fatty tumors, 273
Fevers, 34
Fever, general cause of, 35
Fever, symptoms of, 47
Fevers, treatment of, 45
Fever, hectic, 42
Fever, idiopathic, 36
Fever, inflammatory, 37
Fever, irritative, 44
Fever, irritative, from diffuse suppuration, 127
Fever, typhoid, 40
Fever, varieties of, 36
Femoral artery, Carte's instrument for compressing, 508
Fibrin, plastic, 118
Fibrous tumors, 271
Fimbriated synovial membrane, 440
Fistula, 199
Fluctuation of matter, 183
Fomentation as antiphlogistic, 156
Forceps, Liston's, 386
Forceps, spring-artery, 316
Forceps, torsion, 320
Foot, ulcerous affection of, 232
Fracture, 611; symptoms of, 613; diagnosis of, 614; prognosis of, 615; mode of union, 616; treatment of, 620
Fracture, comminuted, 611
Fracture, compound, 625
Fracture, disunited, 629
Fracture, impacted, 615
Fracture, reduction of, 620
Fracture, simple, 611
Fracture, united, 629
Fracture, with luxation, 625
Fracture, with wound, 611
Fragilitas ossium, 408
Frost-bite, 242
Fungus hæmatodes, 294
Furunculus, 351

Galvanism, in treatment of aneurism, 514.
Ganglia, lymphatic, inflammatory swelling of, 543
Ganglion, 478
Gangræna senilis, 245; treatment of, 251
Gangrene, 235
Gangrene, amputation in, 253
Gangrene, hospital, 348; treatment of, 350
Gangrenous inflammation, 248
Glanders, 585
Glandular tumors, 545
Glover's suture, 564
Gout, 62; symptoms of, 63; treatment of, 63
Granulation, healing by, 177
Granulation of wounds, treatment for, 560, 565
Growth, healing by, 175
Gunshot wounds, 587; treatment of, 591

Healing process, 174
Healing by adhesion, 175
Healing by granulation, 177
Healing by growth, 175
Healing by the modelling process, 176
Heat and moisture, as antiphlogistics, 156
Heat, inflammatory, 104
Hectic fever, 42
Hectic, from suppuration, 126
Hectic, treatment of, 200
Hemiplegia, 74
Hemorrhage, 305
Hemorrhage, arterial, 306
Hemorrhage, escharotics in, 315
Hemorrhage from leech-bites, 146
Hemorrhage, general treatment of, 320
Hemorrhage, inflammatory, 305
Hemorrhage, profuse, sudden death from, 325
Hemorrhage, secondary arterial, 322
Hemorrhage, secondary, after ligature, 515
Hemorrhage, syncope from, 320
Hemorrhage, traumatic, 306
Hemorrhage, venous, 323
Hemorrhagic affections, 64
Hemorrhagic diathesis, 328; treatment of, 329
Hemostasis, 142
Hemostatics, natural, 306
Hemostatic pressure, 311
Hemostatics, surgical, 310
Hemostatics, venous, 324
History of Surgery, 663
Hitch, clove, 641
Hospital erysipelas, 347
Hospital gangrene, 348
Hospital sore, 348
Hunterian operation for aneurism, 497
Hydatids, 276
Hydrophobia, 578; treatment of, 582
Hydrops articuli, 436
Hypertrophy, 257
Hypertrophy of bone, 369
Hypertrophy of cartilage, 458
Hypertrophy of skin, 357
Hypertrophy of tendons, 649
Hypochondriasis, 88
Hysteria, 87

Idiopathic fever, 36
Immersion, suspended animation by, 655
Impacted fracture, 614
Incisions, making of, 567
Incubation, 95
Indolent sore, 218
Induration, 121
Infiltration, purulent, 201
Inflammation, acute, 132
Inflammation, asthenic, 134
Inflammation, circumstances which affect bloodletting in, 140
Inflammation, chronic, 133
Inflammation, chronic, symptoms of, 133
Inflammation, diffuse, of areolar tissue, 354
Inflammation, gangrenous, 248
Inflammation, general bloodletting in, 136
Inflammation, local bleeding in, 142

Inflammation, position in the treatment of, 155
Inflammation, sthenic, 134
Inflammation, true, 98
Inflammatio debilis, 246
Inflammatory affections, counter-irritation in, 159
Inflammatory affections, pressure in, 158
Inflammatory deposits, 117
Inflammatory fever, 37
Inflammatory hemorrhage, 305
Inflammatory process, 94
Inflammatory process, causes of the, 112
Inflammatory process, duration and character of the, 113
Inflammatory process, extension of, 108
Inflammatory process in the exterior of joints, 442
Inflammatory process, local symptoms of, 100
Inflammatory process, local treatment of, 154
Inflammatory process, management of, 134
Inflammatory process, prevention of, 134
Inflammatory process, results of the, 115
Inflammatory process, resolution of, 115
Inflammatory process, theory of the, 95
Inflammatory process, treatment of, 135
Inflammatory process, varieties of the, 132
Inhalation of chloroform and ether, 658
Injuries, 554
Injury, shock of, 81
Integument, affections of the, 333
Integument, entozoa in the, 355
Integument, tumors of the, 356
Intention, union by first, 175
Intention, union by the second, 177
Iodine as a local antiphlogistic, 158
Irritable sore, 223
Irritation, 75
Irritation, local, 75
Irritation, cause of local, 76
Irritation, causes of constitutional, 78
Irritation, constitutional, treatment of, 79
Irritation, general or constitutional, 78
Irritation, treatment of local, 77
Irritative fever, 44
Issue, 164

Joints, destruction of bone in, 466
Joints, diseases of the, 430
Joints, false, 629
Joints, inflammation in exterior of, 442
Joints, loose bodies in, 463
Joints, neuralgia of, 472
Joints, osseous deposit exterior to, 460
Joints resection of, 468
Joints, rheumatic affections of, 442
Joints, wounds of, 473

Knot, reef, 318

Laque, 641
Leeches, use of, 145
Leech-bites, hemorrhage from, 145
Leeching, precautions in, 146
Ligature, as hemostatic, 316
Ligature in aneurism, 498
Ligature, varieties of, in aneurism, 506
Ligature on veins, effects of, 536
Ligature, secondary hemorrhage after, 515
Lightning, suspended animation by, 657
Lipoma, 273, 357
Liston's forceps, 311
Lock-jaw, 594
Luxation, 635

Lymphatics, affections of, 542
Lymphatic ganglia, inflammatory swelling of, 543
Lymphangitis, 542

Malan's flat tourniquet, 313
Malignant pustule, 586
Malignant tumors, 264
Malignant vesicle, 586
Maturation of abscess, 187
Medullary tumor, 290
Melanotic tumor, 295
Membranes, affections of serous and mucous, 358
Membrane, false, 121
Membrane, pyogenic, 121, 181
Mental functions, disorder of, 68
Mercury, as an antiphlogistic, 148
Metastasis, 116
Modelling process, 176
Modelling process, healing by the, 176
Modelling process, in wounds, treatment for, 562
Mollities ossium, 409
Molluscous tumor, 294
Mortification, 235; treatment of, 247
Mortification, acute and chronic, 239
Mortification, constitutional symptoms of, 237; causes of, 239
Mortification, local applications in, 252
Mortification by pressure, 250
Motion, disorder of, 72
Moxa, 166
Mucous membrane, inflammation of, 359
Mucous membrane, tumors of, 361
Mucous sore, 219
Muscle, rupture of, 648

Nævus, 522
Nauseants, as hemostatics, 320
Necrosis, 389; process of, 390; symptoms of, 399; treatment of, 401
Nerves, affections of the, 546
Nerves, tumors of, 551
Nervous system, affections of, 67
Neuralgia, 547; treatment of, 549
Neuralgia of bone, 370
Neuralgia of joints, 472
Neuralgia of periosteum, 368
Neuritis, 546
Neuroma, 551
Nitrate of silver, as a local antiphlogistic, 158
Nitrate of silver, as counter-irritant, 158
Nitric acid, mode of application, 229
Node, 365

Œdema, acute, 118
Œdema, chronic, 171
Opisthotonos, 594
Opium, as an antiphlogistic, 150
Organization of deposit, 118
Osseous deposit exterior to joints, 460
Osseous tumors, 278
Osteoaneurism, 427
Osteocancer, 427
Osteocarcinoma, 427
Osteocephaloma, 423; the diagnosis of, 424
Osteocystoma, 377, 421
Osteoma, 420
Osteomalakia, 409
Osteomelanosis, 427
Osteosarcoma, 422; diagnosis of, 424
Ostitis, 370

Pain, 70
Pain, inflammatory, 104
Pain, subjective, 71
Pain, sympathetic, 70, 106
Papilla, 396
Paralysis, 74
Paralysis, partial, 75
Paraplegia, 74
Periosteum, affections of, 363
Periosteum, malignant disease of, 369
Periosteum, neuralgia of, 368
Periostitis, 363; enlargement of, 366
Petechiæ, 64
Phagedena, sloughing, 227
Phagedenic sore, 227
Phlebitis, 529
Phlebitis, fibrinous, 530
Phlebitis, suppurative, 531
Phlebitis, following deligation, 518
Phlebolites, 539
Phlebotomy, 142
Phlegmonous erysipelas, 340
Phlyctenæ, 235
Plaster, isinglass, 558
Plastic deposit, 119
Plastic fibrin, 118
Pleurothotonos, 595
Plugging, as hemostatic, 313
Podelkoma, 232
Polypus, 361
Polypus, cysto-mucous, 361
Polypus, fibrous, 362
Polypus, medullary, 362
Polypus, simple mucous, 361
Pointing of abscess, 183
Poisons, morbid, 60
Poisons, suspended animation by, 657
Porcellanous deposit, 459
Position, in treatment of inflammation, 155
Pressure, as hemostatic, 311
Pressure in treatment of aneurism, 507
Pressure in inflammatory affections, 158
Pressure, mortification by, 250
Purgatives, as antiphlogistic, 147
Purpura, 64
Purulent infiltration, 201
Pus, characters of, 123
Pus, formation of, 124
Pus varieties of, 125
Pustule, malignant, 586
Pustular sore, 233
Pyæmia, 204
Pyogenic membrane, 121, 181

Quilled suture, 564

Rabies in the dog, 577
Raphania, 244
Rattlesnake, head of the, 576
Reaction after bloodletting, 140, 326
Reaction after shock of injury, 82
Redness, inflammatory, 101
Reduction of dislocation, 640
Reduction of fracture, 620
Reef-knot, 318
Regimen, antiphlogistic, 154
Reproduction of bone, 398; theory of, 406
Reproduction of tumors, 268
Resection of joints, 468
Resolution of inflammatory process, 115
Rest, as an antiphlogistic, 154
Rheumatic affections of joints, 442
Rheumatism, 61
Rheumatism, acute, 61
Rheumatism, chronic, 61
Rheumatism, treatment of, 62
Rickets, 411; treatment of, 415
Rubefacients, 160
Rupture of muscle, 648
Rupture of tendon, 649

Saline medicines, antiphlogistic, 153
Sarcoma, simple, 269
Sarcomata, 269
Scalds, 602; treatment of, 605
Scrofula, 50; signs of, 52; progress of, 53; treatment of, 56
Scrofulous abscess of bone, 378
Scrofulous chronic synovitis, 437
Scrofulous destruction of articular cartilage, 456
Scrofulous sore, 214
Scrofulous tumor, 278
Scurvy, 64; treatment of, 66
Sensation, disorder of, 70
Sensibility, disorder of functional, 107
Sequestra, 389
Serous membrane, inflammation of, 358
Serum, effusion of, 118
Seton, 163
Shock of injury, 81; treatment of, 83
Signoroni's compressor, 312
Silver, nitrate of, as a local antiphlogistic, 158
Sinuous ulcer, 232
Sinus, 197
Skin, hypertrophy of, 357
Skull, mercurio-syphilitic caries of the, 385
Sloughing, 131, 236
Sloughing phagedena, 227
Sloughing sore, 225
Sorbefacients, 167
Sore, cachectic, 217; treatment of, 217
Sore, constitutional, 233
Sore, hospital, 348; treatment of, 350
Sore, indolent, 218
Sore, inflamed, 225
Sore, irritable, 223
Sore, mucous, 219
Sore, phagedenic, 227
Sore, pustular, 232
Sore, scrofulous, 214
Sore, simple purulent, or healthy, 208; treatment of, 209
Sore, sloughing, 225
Sore, weak, 212
Spasm, 74
Sphacelus, 235
Spina ventosa, 378, 422
Spinal irritation, 88
Splints, 621
Sprain, 647
Stimulants, 167
Stings of insects, 575
Strangulation, suspended animation by, 654
Styptics, 315
Subcutaneous wounds, 594
Subluxation, 645
Suppurants as antiphlogistic, 162
Suppuration, 123, 181
Suppuration, hectic from, 126
Suppuration, irritative fever from diffuse, 127
Suppuration of bone, 372
Surgery, historical notice of, 663
Sutures, 563
Suture, common interrupted, 557
Suture, glover's, 564
Suture, quilled, 564
Suture, twisted, 563

Suture needle, 557
Swelling, inflammatory, 102
Sympathetic pain, 70
Syncope, 654
Syncope from hemorrhage, 321
Syncope, suspended animation by, 654
Synovitis, acute, 430
Synovitis, chronic, 435
Synovial membrane, brown fibro-gelatinous degeneration of, 439
Synovial membrane, fimbriated, 440
Synovitis, scrofulous chronic, 437
Syphilis, 60
Syphilis, primary symptoms of, 60
Syphilis, secondary and tertiary, 60

Tartar-emetic as a local antiphlogistic, 162
Tenaculum, 316
Tendon, displacement of, 649
Tendon, hypertrophy of, 649
Tendon, rupture of, 648
Tendon, ununited, 649
Tenotomy knife, 594
Tetanus, 594 ; treatment of, 597
Thecæ, affections of, 477
Thecæ, loose bodies in, 477
Thecitis, 477
Throbbing, inflammatory, 107
Tic douloureux, 548
Torsion forceps, 320
Torsion of arteries, 320
Tobacco enema, 599
Tophi, 443
Tourniquet, 313
Tourniquet, Malan's flat, 313
Transfusion, 321
Traumatic hemorrhage, 306
Trocar and canula, 298
Tubercle, 53
Tubercle, painful subcutaneous, 553
Tubercular abscess of bone, 378
Tumors, 262
Tumor, calcareous, 277
Tumors, cartilaginous, 277
Tumors, chemical constitution of, 265
Tumors, classification of, 269
Tumor, cystic, 275
Tumors, degeneration of, 266
Tumors, discussion of, 266
Tumors, encysted, 301
Tumor, erectile, deligation of, 525
Tumors, exploration of, 297 ; excision of, 299; rules in operating on, 299
Tumors, fatty, 273
Tumors, fibrous, 271
Tumors, glandular, 545
Tumors, malignant, and non-malignant, 263
Tumor, medullary, 290
Tumor, melanotic, 295
Tumor, molluscous, 294
Tumors of bone, 417 ; diagnosis of, 424
Tumors of bone, pulsating, 428
Tumors of bone, vascular, 427
Tumors of mucous membrane, 361
Tumors of the integument, 356
Tumors of nerves, 551
Tumor, origin of, 262
Tumors, osseous, 278
Tumors, reproduction of, 268
Tumors, simple, 269
Tumors, spontaneous cure of, 268
Tumors, tubercular or scrofulous, 278
Tumor, vascular or erectile, 522
Turgescence, vital, 96
Twisted suture, 563
Typhoid fever, 40
Typhomania, 41, 69

Ulcers, 207
Ulcer, articular, 466
Ulcer, constitutional, 233
Ulcer of foot, peculiar, 232
Ulcers, peculiarities of, 231
Ulcer, sinuous, 232
Ulcer, vicarious, 233
Ulcer, varicose, 231
Ulceration, 128
Ulceration, causes and consequences of, 13
Ulceration of bone, 381
Ulceration, theory of, 128
Ulceration, varieties of, 129
Union by first intention, 175
Union by second intention, 177
Union of fracture, 616

Valsalva's treatment of aneurism, 518
Varicose aneurism, 520
Varicose ulcer, 231
Varix, 534
Varix, aneurismal, 524
Varix, arterial, 528
Varix, palliative treatment of, 535
Varix, radical cure of, 536
Vascularization, 120
Vascular excitement, simple, 96
Vascular tumor, 522
Vascular tumors of bone, 427
Veins, affections of, 529
Veins, air in, 539
Veins, effects of ligature on, 536
Venesection, 142
Venous hemorrhage, 323
Venous hemostatics, 324
Vesicants, 162
Vesicle, malignant, 586
Vibices, 64
Vicarious ulcer, 233
Vienna paste, 537

Wardrop's operation for aneurism, 506
Warts, 356
Water-dressing in the treatment of woun 566
Wens, 301
Wounds, 554
Wound, arterial, 306
Wounds by serpents, 575 ; treatment of, 5
Wounds, contused and lacerated, 568
Wounds, gunshot, 587 ; treatment of, 591
Wounds, history of water-dressing in t treatment of, 566
Wounds, incised, 554
Wounds of joints, 473
Wounds, making of, 567
Wounds, poisoned, 570
Wounds, poisoned, by diseased animals, 5
Wounds, poisoned, by healthy animals, 57
Wounds, poisoned, by dissection, 571
Wounds, punctured, 569
Wounds, subcutaneous, 594
Wounds, treatment for adhesion of, 555, 5
Wounds, treatment for granulation of, 560, 5
Wounds, treatment for the modelling proc in, 562
Wounds, use of sutures in, 563

Zymosis, 571

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